PHARMACEUTICAL

AND CHEMICAL

PROBLEMS AND EXERCISES

—IN—

METROLOGY, PERCENTAGE AND PROPORTION, FORTIFICATION,
DILUTION, SPECIFIC WEIGHT, THERMOMETRY,
CHEMICAL FORMULAS AND
EQUATIONS.

INCLUDING NINE HUNDRED CHEMICAL
REACTIONS

— TOGETHER WITH —

RULES AND EXPLANATIONS

— ALSO —

SUFFICIENT RULES GOVERNING

The Latinity of Pharmaceutical Nomenclature and Prescription Writing, with aids to proper accentuation in pronouncing the latinic titles.

INTENDED AS AN AID TO TEACHERS, STUDENTS AND EXAMINERS.

—BY—

OSCAR OLDBERG, Ph.D.,

Professor of Pharmacy, Northwestern University.

SECOND EDITION, REVISED AND GREATLY ENLARGED.

PUBLISHED BY
THE APOTHECARIES' COMPANY
CHICAGO
1892

PREFACE.

Experienced and competent teachers realize how impossible it would be for a student to master any mathematical process without abundant practice. A comparatively ready command of Arithmetic can be gained only by working out numerous examples of the most varied character.

Problems to be solved in writing, and other written exercises, are indispensable in teaching and learning the ready and accurate use of weights and measures; the mutual relations of weight and volume; the calculation of doses; computations of proportions and strength in making pharmaceutical preparations, or in mixing, diluting or fortifying substances to produce any required result; the correct interpretation of formulas and prescriptions; the verification of the official standards of strength; the application of necessary corrections; the intelligent and ready use of chemical notation and combining numbers; ability to understand and represent chemical reactions and to accurately predict and compute results; in the construction, use, or verification of the working formulas for medicinal substances; in making proper and safe use of the quantitative tests prescribed by the Pharmacopœia; and to learn to use correct Pharmaceutical nomenclature.

In the opinion of the Author, based upon nearly twenty years' experience as a teacher of pharmaceutical students, the problems and exercises presented in this volume are satisfactory and sufficient in kind as well as in number. Nearly 800 chemical reactions are included in Parts XVII and XVIII.

Rules for the solution of many classes of problems are given, together with ample explanations for the benefit of the student who may be obliged to work without the aid of an instructor. Part XXI is devoted to the study of systematic pharmaceutical nomenclature and the latinity of that nomenclature as used in the pharmacopœias of the present, and the latinic terms employed in prescription writing. The Latin declensions are stated, with sufficient examples, the proper accentuation to be observed in pronouncing the latinic titles is indicated, and rules governing abbreviation are also given.

This book is intended for pharmaceutical students, for class work in the instruction rooms under the direction of a teacher, as well as for individual work without the aid of a teacher. It may also be found a convenient and valuable aid in the selection of suitable problems for use in examinations.

In the use of this book with my own classes, one lesson weekly, occupying an hour and a half, is devoted to this work in the class room, where each student has the opportunity to receive such help as he may need, and a suitable additional amount of work is required to be done out of the school. The students write their answers in note books used for this purpose only, and these books are handed to the teacher for examination once a week, and returned with such notes as may be

required. In these exercises the students are allowed the free use of whatever reference books they may wish to consult. Some portions of these problems and exercises are so simple that most of the students are able to demonstrate that they may be safely excused from them, but all pharmaceutical students should be able to do any part of this work before they have finished their course.

The TABLE OF CONTENTS, p. 7, will further indicate the scope of the book.

Those who may desire more extended practice in "prescription latin" will find numerous examples of correct and incorrect construction and abbreviation in my new book entitled "1,500 Prescriptions of All Kinds, Right and Wrong."

OSCAR OLDBERG.

CHICAGO, *September, 1892.*

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PART XVII.

PHARMACEUTICAL PROBLEMS AND EXERCISES.

PART I.

THE METRIC SYSTEM.

1.—Give the meaning of the prefixes: Myria-, Kilo-, Hekto-, Deka-, Deci-, Centi- and Milli-.

2.—What is the length of the terrestrial meridian in meters?

3.—What is the relation between the liter and the kilogram?

4.—What is the volume of one gram of water?

5.—What is the theoretical basis of the Metric System?

6.—What is the actual standard of linear measure of the Metric System?

7.—Define the theoretical kilogram.

8.—Define the actual kilogram.

9.—Trace the relation of the milligram to the meter.

10.—How would you designate the international prototype standard of long measure of the Metric System?

11.—By what title is the prototype standard meter of the United States known?

12.—Name the countries in which the Decimal System of weights and measures based upon the meter is not obligatory for *commercial* purposes.

LINEAR MEASURE.

13.—Give the number of millimeters in one myriameter.

14.—Give the number of millimeters in one kilometer.

15.—Give the number of millimeters in one hektometer.

16.—Give the number of millimeters in one dekameter.

17.—Give the number of millimeters in one meter.

18.—Give the number of millimeters in one decimeter.

19.—Give the number of millimeters in one centi meter.

20.—State the number of micromillimeters in one millimeter.

21.—Reduce 103.072 meters to centimeters.

22.—Reduce 0.0001 meter to millimeters.

23.—Reduce 1.0303 meters to millimeters.

24.—Reduce 2 hektometers to millimeters.

25.—Reduce 0.404 centimeters to millimeters.

26.—Reduce 0.1 dekameter to millimeters.

27.—Reduce 0.1 decimeter to millimeters.

28.—Reduce 0.0001 kilometer to millimeters.

29.—Reduce 0.100101 myriameter to millimeters.

30.—Reduce 110.110 millimeters to kilometers.

31.—Reduce 1101.01 centimeters to kilometers.

32.—Reduce 0.700 decimeters to kilometers.

33.—Reduce 10,000 decimeters to kilometers.

34.—Reduce 10,000 dekameters to myriameters.

35.—Reduce 10,000 centimeters to hektometers.

36.—Reduce 10,000 hektometers to kilometers.

37.—Reduce 0.01 kilometers to meters.

38.—Reduce 103.405 centimeters to meters.

39.—Reduce 0.270 hektometers to meters.

40.—Reduce 10.04001 millimeters to meters.

41.—Reduce 3.45 dekameters to meters.

42.—Reduce 345 decimeters to meters.

43.—Write *in figures*:—Thirteen millimeters, in meter units.

44.—Write *in figures*:—Eleven centimeters, in meter units.

45.—Write *in figures*:—Two hundred and seven decimeters, in centimeter units.

46.—Write *in figures*:—One-half kilometer, in dekameters.

47.—Write *in figures*:—One thousand and five millimeters, in centimeters.

48.—Write *in figures*:—One thousand and five centimeters, in millimeters.

49.—Add together:—One million micromillimeters, 75 millimeters, 75 centimeters, 4 dekameters, 4 decimeters, 0.004 kilometer, 13 hektometers, 4.13 meters, and 0.0002 myriameters, and state the sum in meters.

50.—Add together:—1 M, 1,000 mM, 0.1 DM, 100 cM, 10 dM, 0.01 HM, and 0.001 KM, and give the answer in M.

SURFACE MEASURE.

51.—State the number of square-meters contained in the ARE.

52.—What is the other title of the square-dekameter in the Metric System?

53.—What other name is given to the square meter?

54.—State the number of centiares in the hektare.

55.—State the number of ares in the hektare.

56.—State the number of centiares in the are.

57.—How many square-meters in one square dekameter?

58.—How many square-meters in one square-kilometer?

59.—How many square-centimeters in one square-meter?

60.—How many square-millimeters in one square-centimeter?

61.—Reduce 23.05 square-millimeters to square-centimeters.

62.—Reduce 30,000 square-centimeters to square-meters.

63.—Reduce 50,000 square-meters to square kilometers.

64.—Reduce 25 square kilometers to ares.

65.—Reduce 100 square-kilometers to hektares.

66.—Add together:—300 centiares, 3 ares, 30 hektares, 0.3 square kilometer, 3,000 square-centimeters, 30 square-decimeters, 3 square-dekameters, 3,000 square-millimeters, and 0.03 square-hektometers, and state the sum in square-meters.

CUBIC MEASURE AND MEASURES OF CAPACITY.

67.—State the number of cubic-centimeters in one cubic-decimeter.

68.—State the number of cubic-millimeters in one cubic-centimeter.

69.—State the number of cubic-meters in a cubic-kilometer.

70.—State the number of centimeters in one cubic-meter.

71.—What other name is applied to the cubic-meter?

72.—What other name is applied to the cubic-decimeter?

73.—How many cubic-decimeters are contained in one cubic-meter?

74.—How many steres are contained in one liter?

75.—How many steres in one kiloliter?

76.—How many milliliters in one stere?

77.—How many cubic-centimeters in one liter?

78.—How many milliliters in one liter?

79.—How many C.c. in $\frac{1}{3}$ of $\frac{1}{4}$ of 0.024 liter?

80.—Reduce 1,040.401 milliliters to liters.

81.—Reduce 3.004 cubic-decimeters to C.c.

82.—Reduce 140.03 liters to C.c.

83.—Reduce 0.0002 liters to C.c.

84.—Reduce 15,432 C.c. to cubic-decimeters.

85.—Reduce 304 centiliters to C.c.

86.—Write *in figures:*—Five thousand and seven C.c., in deciliters.

87.—Write *in figures:*—Twenty-five hundred milliliters, in liters.

88.—Write *in figures:*—Two thousand and thirteen centiliters, in C.c.

89.—Write *in figures:*—One-half milliliter, in C.c.

90.—Add:—4 liters and 40 milliliters, and state the sum in C.c.

91.—Subtract 3,456 C.c. from 5 liters, and state the remainder in deciliters.

92.—Add together:—1 stere, 3 kiloliters, 5 cubic-meters, 5 liters, 0.5 dekaliters, 0.05 hektoliters, 0.005 kiloliters, 10 deciliters, 1,000 milliliters, 100 centiliters, and 5 cubic-decimeters, and state the sum in C.c.

93.—Subtract 1 C.c. from 10 liters, and state the remainder in liters.

94.—Subtract 10 milliliters from 1 liter, and state the remainder in C.c.

95.—Subtract 10 C.c. from 1 cub. dM, and state the remainder in mL.

WEIGHT.

96.—State the number of grams in one kilogram.

97.—State the number of grams in one centigram.

98.—State the number of centigrams in one dekagram.

99.—State the number of milligrams in one kilogram.

100.—Reduce 0.048 Gm. to milligrams.

101.—Reduce 35.005 centigrams to milligrams.

102.—Reduce 0.07005 kilograms to milligrams.

103.—Reduce 7.4008 Gm. to milligrams.

104.—Reduce 0.0123 dekagrams to milligrams.

105.—Reduce 0.123 hektograms to milligrams.

106.—Reduce 7,093.307 centigrams to Gm.

107.—Reduce 0.07 milligrams to Gm.

108.—Reduce 0.00306 kilograms to Gm.

109.—Reduce 304.5 dekagrams to Gm.

110.—Write *in words:* 0.001 Gm., in Gm.

111.—Write *in words:* 0.0001 kilograms, in Gm.

112.—Write *in words:* 0.01 milligrams, in Gm.

113.—Write *in words:* 0.100 Gm., in centigrams.

114.—Write *in figures:* 4 kilograms, in dekagrams.

115.—Write *in figures:* 0.4 hektograms, in Gm.

116.—Write *in figures:* 0.003 Gm., in milligrams.

117.—Write *in figures:* 0.202 Gm., in centigrams.

118.—Write *in figures:* Eleven hundred centigrams, in Gm.

119.—Write *in figures:* One thousand and two milligrams, in Gm.

120.—Write 4 kilograms, 47 Gm., and 4 centigrams, in one sum, in Gm.

121.—Add together:—130 centigrams, 13 milligrams, 130 Gm., 13 kilograms, 1.30 dekagrams, and 0.013 hektograms, and state the sum in decigrams.

122.—Subtract 65 centigrams from 1 hektogram, and state the remainder in milligrams.

123.—How is the word gram abbreviated?

124.—Add together:—One kilogram and one milligram, and write the answer *in figures* and in grams.

125.—Add together:—1 Gm, 2 KGm, 1 Kilo, 3 dGm, 5 DGm, 100 mGm, 10 cGm, and 10 HGm, and state the sum in Gm.

PART II.

AMERICAN AND BRITISH WEIGHTS AND MEASURES.

LONG MEASURE.

126.—What is the basis of English linear measure?

127.—What relation does the inch bear to the length of the seconds-pendulum of the Greenwich Observatory?

128.—How many yards in one mile?

129.—How many miles in one league?

130.—How many furlongs in one league?

131.—How many poles in one mile?

132.—How many rods in one furlong?

133.—How many perches in one pole?

134.—How many yards in one rod?

135.—How many inches in one pole?

136.—How many feet in one fathom?

137.—How many inches in one hand?

138.—How many inches in one palm?

139.—How many inches in one span?

140.—How many spans in one yard?

141.—Add together:—100 inches, 2 feet, $\frac{1}{2}$ yard, $\frac{1}{8}$ rod, $\frac{1}{40}$ furlong, $\frac{1}{320}$ mile, and $\frac{1}{960}$ league.

142.—How many chains in a mile?

SURFACE MEASURE.

143.—How many square-rods in an acre?

144.—How many roods in a square mile?

145.—How many acres in a square-mile?

146.—How many square-feet in an acre?

147.—How many square-inches in a square-foot?

148.—What part of an acre is a piece of land 50 ft. by 100 ft.?

149.—State the difference between 4,840 square-yards, and 4,840 yards square.

150.—How many square-perches in one acre?

MEASURES OF CAPACITY.

151.—How many cubic-inches in one cubic-foot?

152.—How many cubic-feet in one cubic-yard?

153.—What is the origin of the Dry Gallon of the United States?

154.—What is the origin of the Liquid Gallon of the United States?

155.—How many cubic-inches in the Winchester gallon?

156.—How many cubic-inches in the Imperial gallon?

157.—How many cubic-inches in the Wine gallon?

158.—How many cubic-inches in the Liquid gallon of the United States?

159.—How many cubic-inches in the Dry gallon of the United States?

160.—How many galions in one bushel, and what kind of gallons?

161.—How many quarts in one peck?

162.—How many cubic-inches in a bushel?

163.—How many cubic-inches in a dry quart?

164.—How many cubic-inches in a liquid quart?

165.—How many pints in a dry gallon?

166.—How many pints in a liquid gallon?

167.—How many pints in an Imperial gallon?

168.—What is the difference between the Apothecaries' pint and the Wine pint?

169.—How many fluid-ounces in a U. S. liquid pint?

170.—How many fluid-ounces in an Imperial pint?

171.—State the equivalent of the Imperial pint in U. S. liquid pints.

172.—What is the basis of the Imperial gallon?

173.—How many minims in the U. S. Apothecaries' fluid-ounce?

174.—How many minims in the Imperial fluid-ounce?

175.—What is the difference between an Imperial minim and a U. S. Apothecaries' minim?

176.—State in Imperial minims the difference between the Imperial fluid-ounce and the U. S. Apothecaries' fluid-ounce.

177.—How many Imperial minims in an Imperial pint?

178.—How many U. S. Apothecaries' minims in a U. S. Apothecaries' pint?

179.—How many Imperial minims in a U. S. Apothecaries' pint?

180.—How many Imperial minims equal one U. S. Apothecaries' fluid-ounce?

181.—How many fluid-drachms in an Imperial fluid-ounce?

182.—How many fluid-drachms in a U. S. Apothecaries' fluid-ounce?

183.—How many cubic-inches in a U. S. Apothecaries' fluid-ounce?

184.—How many Imperial gallons in one Wine gallon?

185.—How many Imperial quarts in one Wine quart?

186.—How many Imperial fluid-ounces in one U. S. fluid-ounce?

187.—How many Imperial minims in one U. S. minim?

188.—How many U. S. fluid-ounces in one Wine gallon?

189.—How many U. S. fluid-ounces in an Imperial gallon?

190.—How many U. S. fluid-ounces equal 16 Imperial fluid-ounces?

191.—How many U. S. fluid-drachms in 2.50 Wine pints?

192.—How many U. S. fluid-drachms in 1.05 Wine gallons?

193.—How many U. S. fluid-drachms in 0.125 U. S. fluid-ounces?

194.—How many Imperial fluid-ounces in one Imperial gallon?

195.—How many Imperial fluid-ounces in one Wine gallon?

196.—How many U. S. fluid-ounces equal 100 Imperial fluid-ounces?

197.—Write the symbols used for the fluid-ounce, the fluid drachm, and the minim, of U. S. Apothecaries' fluid measure.

198.—Write the symbols used to designate the fluid-ounce, fluid-drachm, and minim, of British Apothecaries' fluid measure.

199.—Write the sign used to designate the Medicinal gallon, and the sign used to designate the Medicinal pint.

WEIGHT.

200.—What is the commercial weight of the Imperial System?

201.—What is the customary commercial weight of the United States?

202.—What is the basis of the Avoirdupois-pound?

203.—How is the Avoirdupois-pound subdivided?

204.—How many drachms in the Avoirdupois-ounce?

205.—How many ounces in the Avoirdupois-pound?

206.—How many grains in the Avoirdupois-pound?

207.—How many grains in the Imperial-pound?

208.—How many grains in the United States commercial pound?

209.—How many grains in the Troy-pound?

210.—What is the basis of Troy-weight?

211.—How many ounces in a Troy-pound?

212.—What is the Medicinal ounce of the United States?

213.—How is the Troy-ounce subdivided?

214.—How is the Apothecaries' ounce subdivided?

215.—What is the Medicinal ounce of the Imperial System?

216.—How many drachms in the English Medicinal ounce?

217.—How many grains in the English Medicinal ounce?

218.—What weights and measures are used for weighing gold and silver?

219.—What is a pennyweight?

220.—What is a scruple?

221.—What is the difference between the English scruple and the American scruple?

222.—Write the symbols for the U. S. Apothecaries' ounce, drachm, scruple, and grain.

223.—How many Apothecaries' ounces in 100 Avoirdupois-ounces?

224.—How many U. S. Apothecaries' ounces in one Avoirdupois-pound?

225.—How many Avoirdupois-ounces equal 24 Apothecaries' ounces?

MISCELLANEOUS PROBLEMS.

226.—State the equivalent of 3.03 meters in English inches.

227.—State the equivalent of 3.03 millimeters in English inches.

228.—State the equivalent of 0.303 centimeters in inches.

229.—State the equivalent of 4 inches in millimeters.

230.—State the equivalent of one foot in millimeters.

231.—State the equivalent of 0.01 inch in millimeters.

232.—How many centimeters equal one inch?

233.—How many centimeters equal 4 feet?

234.—How many centimeters equal 0.1 inch?

235.—What is the length of the terrestrial meridian in inches?

236.—What is the length of the Greenwich seconds-pendulum in inches?

237.—State the difference in length between the yard and the meter, in inches.

238.—State the difference in length between the yard and the meter, in centimeters.

239.—State the exact equivalent of the meter, in English inches.

240.—State the exact equivalent of the yard, in meters.

241.—How many millimeters equal one inch?

242.—How many centimeters equal one inch?

243.—How many inches equal 100 millimeters?

244.—How many meters equal one mile?

245.—How many meters equal $7\frac{1}{2}$ yards?

246.—How many meters equal 144 inches?

247.—How many square-feet are contained in a rectangular area 2 feet wide and 30 inches long?

248.—How many square-inches of surface has a cube measuring 2 inches in each direction?

249.—How many square-centimeters of surface has a block 60 millimeters long, 30 millimeters wide, and 20 millimeters thick?

250.—How many square-inches equal one square-meter?

251.—Reduce 0.03 square-feet to square-centimeters.

252.—Reduce one acre to square-meters.

253.—Reduce 1 hektare to acres.

254.—Reduce 2 square-miles to square-kilometers.

255.—Add one square-kilometer, one square-meter, and one square-centimeter, and state the sum in square-meters.

256.—Add one square-foot, 12 square-inches, and $\frac{1}{3}$ square-yard, and state the sum in square-feet.

257.—How many cubic-inches are contained in a block 6 inches long, 5 inches wide, and 4 inches thick?

258.—How many wine gallons equal one cubic-foot?

259.—How many cubic-feet of space in a room 12x15x10 feet?

260.—State the equivalent of one cubic-meter, in liters.

261.—State the equivalent of one wine-gallon, in cubic-centimeters.

262.—State the equivalent of one liter, in cubic-inches.

263.—State the equivalent of one cubic-inch, in cubic-centimeters.

264.—How many cubic-centimeters in one wine gallon?

265.—How many cubic-centimeters in one U. S. fluid-ounce?

266.—How many cubic-centimeters in an Imperial fluid ounce?

267.—How many cubic-centimeters in an Imperial gallon?

268.—How many cubic-centimeters equal 60 U. S. minims?

269.—How many cubic-centimeters equal 60 Imperial minims?

270.—How many cubic-inches equal 1101 millimeters?

271.—How many U. S. minims equal 4.04 C.c.?

272.—How many minims equal 0.05 liters?

273.—How many U. S. minims equal 15 C.c.?

274.—How many U. S. minims equal one milliliter?

275.—How many cubic-centimeters equal 300 Imperial minims?

276.—How many liters equal 5 wine-pints?

277.—How many liters equal 6 Imperial pints?

278.—How many liters equal 100 U. S. fluid-ounces?

279.—How many liters equal 100 Imperial fluid-ounces?

280.—How many Imperial minims equal 0.10 liter?

281.—How many Imperial minims equal one cubic-centimeter?

282.—How many Imperial fluid-ounces equal one wine-gallon?

283.—How many Imperial fluid-ounces equal one liter?

284.—How many cubic-centimeters equal one dry quart?

285.—How many cubic-centimeters equal one wine-quart?

286.—How many cubic-centimeters equal one Imperial quart?

287.—How many Gm. equal one Avoirdupois-pound?

288.—How many Gm. equal one Troy-pound?

289.—How many Gm. equal one Avoirdupois ounce?

290.—How many Gm. equal an Apothecaries' ounce?

291.—How many Gm. equal a Troy-ounce?

292.—State the exact equivalent of the Gm., in grains.

293.—State the equivalent of the grain in milligrams.

294.—How many Gm. equal 6 Avoirdupois-ounces?

295.—How many Gm. equal 9 Troy-ounces?

296.—How many Gm. equal 5.50 Avoirdupois-pounds?

297.—How many Gm. equal 0.50 Avoirdupois-pounds?

298.—How many Gm. equal 500 grains?

299.—How many grains equal 100,000 Gm.?

300.—How many grains equal one centigram?

301.—State the equivalent of the decigram, in grains.

302.—State the equivalent of the milligram, in grains.

303.—State the equivalent of 65 milligrams, in grains.

304.—How many Avoirdupois-ounces equal 0.40 kilogram?

305.—How many Avoirdupois-ounces equal 453 Gm.?

306.—How many Avoirdupois-ounces equal 100 Troy-ounces?

307.—How many Apothecaries' ounces equal one Avoirdupois-pound?

308.—How many Apothecaries' ounces equal one kilogram?

309.—How many Apothecaries' ounces equal 100 Avoirdupois-ounces?

310.—How many Apothecaries' ounces equal 373 Gm.?

311.—State the equivalent of 100 grains, in decigrams.

312.—State the equivalent of 1,000 grains, in centigrams.

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313.—State the equivalent of one grain, in milligrams.

314.—State the equivalent of 10 grains, in Gm.

315.—State the equivalent of 3 grains, in decigrams.

316.—State the difference between 32 Troy-ounces, and one kilogram, in grains.

317.—Add together:—ʒij, ℥iij, ʒix, ℈ij, and ℥xvj, and give the sum in grains.

318.—Add together:—12 oz, ℥iv, and ½ ℔, and give the answer in grains.

319.—Subtract ℈ijss from 1 oz, and give the answer in grains.

320.—Add together:—Oss, f℥vj, Cj, fʒx, and ♏C, and give the answer in minims.

321.—State the quantities required of each of the following named ingredients to make 24 pills, each pill containing $\frac{1}{10}$ gr. Extract of Belladonna, $\frac{1}{3}$ gr. Aloin, $\frac{1}{60}$ gr. Strychnine, and 1 gr. Extract of Rhamnus Purshiana.

322.—State the quantities required of each of the following named ingredients to make one pint of an elixir, of which each fluid-drachm is to contain 1 gr. Quinine, $\frac{1}{100}$ gr. Strychnine, and 2 gr. Soluble Phosphate of Iron.

PART III.

WEIGHT AND VOLUME.

323.—What is the weight in air of one cubic-inch of water at 62° F., in grains?

324.—What is the weight in Gm. of one C.c. of water, at maximum density in vacuo?

325.—What is the weight of one liter of water?

326.—What is the weight of one deciliter of water?

327.—What is the weight, in grains, of one U. S. fluid-ounce of water?

328.—What is the weight, in Troy-ounces, of one liter of water?

329.—What is the weight, in Avoirdupois-ounces, of 96 U. S. fluid-ounces of water?

330.—What is the weight, in Avoirdupois-ounces, of 3 wine-pints of water?

331.—What is the weight, in grains, of one C.c. of water, at 22° C.?

332.—What is the weight of 24 U. S. fluid-ounces of water, in Avoirdupois-ounces?

333.—What is the weight of a U. S. minim of water, in grains?

334.—State the weight of a U. S. fluid-drachm of water, in drachms.

335.—State the weight of a U. S. fluid-ounce of water, in U.S. Apothecaries' ounces.

336.—State the weight of an Imperial pint of water, in Avoirdupois-ounces.

337.—What is the weight of an Imperial minim of water, in grains?

338.—What is the weight of an Imperial fluid-ounce of water, in grains?

339.—What is the weight of an Imperial gallon of water, at 62° F., in air?

340.—What is the volume of 5 Avoirdupois-pounds of water, at 62° F., expressed in Imperial pints?

341.—What is the volume of 1 Apothecaries' ounce of water, in U. S. fluid-ounces?

342.—What is the volume of 1 grain of water, in U. S. minims?

343.—What is the volume of 1 grain of water, in Imperial minims?

PART IV.

PRICES.

344.—If the price of muslin be 4 cents a yard, what is the price per meter?

345.—The price per meter being 10 cents, what is the price per yard?

346.—The price per liter being $1.30, what is the price per gallon?

347.—If 3 gallons cost $2.80, what is the price per liter?

348.—If the price per liter be $2.11, what is the price per wine-pint?

349.—If the price per yard is 90 cents, what is the price per meter?

350.—What is the cost per kilogram, at $2 20 per pound?

351.—At 36 cents per ounce, what is the price per kilogram?

352.—At $1.00 per kilogram, what is the price per Avoirdupois-ounce?

353.—At $1.00 per kilogram, what is the price per Avoirdupois-pound?

354.—At $1.00 per kilogram, how many Avoirdupois-pounds will $10.00 buy?

355.—At $2.50 per Gm., what is the price per grain?

356.—At 6 cents per grain, what is the price per Gm.?

PART V.

DOSES.

Rule for estimating the doses required for children and old persons from the known ordinary adult dose:

Dr. YOUNG'S RULE: *Divide the age of the child (stated in years) by that age + 12, and by the quotient multiply the full ordinary adult dose.* The product is the dose to be given to a child of that age.

Ex. The child is 3 years old. Then $\frac{3}{3+12} = \frac{3}{15} = \frac{1}{5}$, and therefore a child 3 years of age should be given $\frac{1}{5}$ of the adult dose. If the dose for an adult is 10 grains, then the dose for a child 3 years old should be $10 \times \frac{1}{5}$, or 2 grains. If the adult dose is $\frac{1}{3}$ grain, then the dose for a child of 3 years will be $\frac{1}{3} \times \frac{1}{5} = \frac{1}{15}$ grain.

Dr. COWLING'S RULE: Add 1 to the age of the child (in years), and divide by 24; then multiply the adult dose by the quotient.

By this rule the dose for a child 3 years old would be $\frac{1}{6}$ of the adult dose, for $\frac{3+1}{24} = \frac{4}{24} = \frac{1}{6}$.

(Scarcely more than one-half of the dose thus computed for a child should be given when the medicine is a powerful narcotic. On the other hand, two or three times the quantity found by these rules may be given of mild cathartics, alteratives and tonics.)

Another scale by which doses for different ages are fixed is as follows:

Ages.	Number of sixteenths of the full adult dose:
1 to 4 months	1
5 to 8 months	1½
9 to 18 months	2
1½ to 3 years	3
4 years	4
5 "	5
6 "	6
7 "	7
8 "	8
10 "	9
12 "	10
13 "	11
15 "	12
18 "	13
20 "	14
25 "	15
30 to 45 years	16
50 years	14
60 "	12
40 "	10
100 "	8

N. B.—The Pharmacist can, of course, not pass intelligent judgment in regard to the relative doses which may be proper; but the object of these rules is to give him an approximately safe guide in dispensing. The adult dose is subject to great variation.

For *hypodermatic injection* the dose is one-half of that administered by mouth.

By the rectum the dose is about 25 per cent. greater than *per orem.*

357.—If the full adult dose of Camphor be 5 grains, what is about the dose for a child 10 years old?

358.—The full adult dose being 30 minims, what is about the dose for a child 4 years old?

359.—The full adult dose being 1 fluid-drachm, what is about the dose for a patient of 60 years?

360.—The full adult dose by mouth being 1 grain, what is about the dose for a hypodermatic injection for a girl of 15 years?

361.—The full adult dose by mouth being half an ounce, what is the approximate dose for an enema for a man of 70 years?

362.—The full dose for an adult is $\frac{1}{30}$ grain; multiply that by $\frac{12}{16}$ to find the dose for a child of 15. What is the answer?

363.—If the full adult dose is 3 grains, how many single doses for a boy of 8 years are contained in one gram?

364.—How large a quantity of the remedy is required for four doses daily, for a period of ten days, for a youth of 18 years, if the full adult dose is $\frac{1}{64}$ grain?

365.—A mixture measuring four fluid-ounces, to be taken in teaspoonful doses, contains ℥j of an active remedy. What is the single dose?

366.—A prescription calls for six powders, each to contain $\frac{1}{8}$ grain of an active constituent. What is the whole quantity required of that constituent?

367.—The full adult dose being $\frac{1}{200}$ grain, how many doses for a woman 25 years old are contained in $\frac{1}{24}$ grain?

368.—How much of the remedy must be put into an eight-ounce mixture to make each dessertspoonful contain $\frac{1}{4}$ grain?

369.—A prescription calls for ℥j of a salt to be dispensed in an six-ounce mixture of which the dose is to be a tablespoonful. What is the single dose of the salt?

370.—A prescription calls for 10 grains of an active remedy to be divided between 30 pills and the directions are to take 3 pills morning and night. What is the single dose of that remedy?

371.—If the dose be 5 grains, how much must be used to make 12 pills, two to be taken at a time.

PART VI.

PERCENTAGE AND PROPORTION.

To find the proportions required for making mixtures and solutions of given strength, and to find the per cent. strength of mixtures and solutions made out of ingredients or materials the proportions of which are known, are problems of frequent occurrence in pharmaceutical work.

For convenience we will designate the active or valuable constituent in any mixture, dilution, or solution as the *positive ingredient*, we will call the inactive ingredient, admixture, or solvent the *diluent*, and the mixture, dilution or solution will be called a *mixture*.

Rules for computing the quantities required to make any mixtures, dilutions or solutions desired:—

Rule I. *Given:* the quantity of positive ingredient (a) to be made into a mixture of given per cent. strength (b); *To find:* the mass of the mixture (c) produced, and the quantity of diluent (d) required to be added to a.

Multiply the number of weight units representing the quantity of positive ingredient (a) *by 100, and divide the product by the per cent. strength* (b) *of the mixture desired. The quotient is the quantity of mixture* (c) *obtained from the whole quantity of the positive ingredient. To find the quantity of diluent required* (d), *sub-*

tract from that quotient (c) the quantity of positive ingredient to be used (a). Thus—

$$\frac{a \times 100}{b} = c; \text{ and } c - a = d.$$

Ex. Suppose we have 24 ounces of sodium carbonate and wish to make an 8 per cent. solution out of the whole quantity. How much solution will it make, and how much water is required?

Solution—

$$\frac{24 \times 100}{8} = 300; \text{ and } 300 - 24 = 276.$$

For: $24 : \times :: 8 : 100$, and 276 ounces of water added to the 24 ounces of sodium carbonate will make 300 ounces of solution having 8 per cent. strength.

RULE II. *Given:* the quantity of diluent (*d*) to be used in making a mixture of given per cent. strength (*b*); *To find:* the quantity of positive ingredient (*a*) required to be added to *d*, and the quantity of mixture produced.

Multiply the weight of the diluent (d) by the desired per cent. strength of the mixture (b), and divide the product by 100 minus the per cent. strength desired (b); the quotient is the number of weight units required of the positive ingredient (a), and the sum of a and d is the quantity of mixture produced (c).

Thus—

$$\frac{d \times b}{100 - b} = a; \text{ and } a + d = c.$$

Ex. Suppose we have 100 Gm. of water and wish to add to it a sufficient quantity of cocaine hydrochlorate to produce a solution of 4 per cent. strength. Then, how much cocaine hydrochlorate must be added to the

100 Gm. of water, and what quantity of 4 per cent. solution will be produced?

Solution—

$$\frac{100\times4}{100-4}=4.166;\text{ and }4.166+100=104.166.$$

For: $100-4:100::4:\times$, and 4.166 Gm. cocaine hydrochlorate added to 100 Gm. of water will make 104.166 Gm. of solution of 4 per cent. strength.

RULE III. *Given:* the desired quantity of mixture (c) of a definite per cent. strength (b); *To find:* the quantities of positive ingredient (a) and diluent (d), respectively, required to produce it.

Multiply the weight of the desired mixture (c) *by the required per cent. strength* (b), *and divide the product by 100. The quotient is the quantity required of the positive ingredient* (a), *and the quantity required of the diluent* (d) *is found by subtracting a from c.* Thus—

$$\frac{c\times b}{100}=a;\text{ and }c-a=d.$$

Ex. We require 50 Gm. of a mixture of opium and sugar of milk, containing 6 per cent. of opium. How much opium and how much milk sugar must be used?

Solution—

$$\frac{50\times6}{100}=3;\text{ and }50-3=47.$$

For: $100:6::50:\times$, and 3 Gm. of opium mixed with 47 Gm. of milk sugar will produce 50 Gm. of a mixture of 6 per cent. strength.

Rules for finding the percentage strength of any mixture.

RULE IV. *Given:* The weight of the mixture (c) and the weight of the positive ingredient (a) contained in it;

To find: the number expressing the percentage strength (b) of the mixture.

Multiply the weight of the positive ingredient (a) *contained in the mixture by 100, and divide the product by the weight of the whole mixture* (c)*; the quotient expresses the per cent. strength* (b). Thus—

$$\frac{a \times 100}{c} = b.$$

Ex. If 50 Gm. of podophyllum contain 2.25 Gm. of resin, what is the percentage of resin in the root?

Solution—

$$\frac{2.25 \times 100}{50} = 4.50.$$

For: $50 : 2.25 : : 100 : \times$, and the root is found to contain 4.50 per cent. resin.

RULE V. *Given:* The weight of the mixture (c) and the weight of the diluent (d); *To find:* the percentage strength (b).

Deduct the weight of the diluent (d) *from the weight of the mixture* (c), *multiply the remainder by 100, and divide the product by the weight of the mixture* (c)*; the quotient expresses the percentage strength* (b). Thus—

$$\frac{(c-d) \times 100}{c} = b.$$

Ex. If 11 ounces of alcohol be macerated at 15°C. with a larger quantity of iodine than that quantity of alcohol will dissolve, and the total weight of the saturated solution formed is found to be 12 ounces; what is the percentage strength of that saturated solution?

Solution—

$$\frac{(12-11) \times 100}{12} = 8.33.$$

For: $12 : 12 - 11 :: 100 : \times$, and the strength of the solution of iodine is 8.33 per cent.

---

372. The official Solution of Chloride of Iron, U. S. P., 1880, contained 63 per cent. crystallized ferric chloride. How many avoirdupois-ounces of that solution can be made from $\frac{1}{4}$ ℔ solid ferric chloride, and how much water will be required?

373.—How many avoirdupois-ounces, 5 per cent. solution, can be made of 1 avoirdupois-pound of borax?

374.—How many Gm. of a mixture of resin of podophyllum and milk sugar, containing 20 per cent. of the active remedy, can be made of one avoirdupois-ounce of the resin.

375.—I have an avoirdupois-ounce of opium containing 10 per cent. of morphine, and I want to mix it with enough milk sugar to produce a mixture containing 1 per cent. of morphine. How many Gm. of such a mixture can be made from the whole ounce of opium, and how much milk sugar is required?

376.—How many Gm. of 12 per cent. solution can be made of one kilogram of granulated zinc chloride?

377.—How many ounces of a 6 per cent. solution of carbolic acid in olive oil can be made of one pound of the acid?

378.—How many pounds diluted acetic acid (6%) can be made of one pound absolute acetic acid?

379.—How many ounces of carbolic acid must be added to one pound of glycerin to produce a 50 per cent. solution?

380.—How many ounces of extract of belladonna must be used with one pound of benzoinated Lard to produce the official ointment of belladonna (10%)?

381.—How many ounces of oil of peppermint must be added to one pound of alcohol to make a 12 per cent. solution?

382.—How many grains cocaine hydrochlorate must be added to 455.25 grains of water to produce a 3 per cent. solution?

383.—What quantities of tannin and benzoinated lard are required to make one ounce of a 10 per cent. ointment?

384.—What quantities of sulphur and benzoinated lard are required for one pound of a 30 per cent. ointment?

385.—What quantities of oil of orange peel and alcohol are required to make one pound of spirit of orange of 6 per cent. strength?

386.—How much boric acid and powdered talcum must be used to make one pound of a powder containing 3 per cent. of the acid?

387.—Compound jalap powder contains 35 per cent. jalap and 65 per cent. cream of tartar. How much of each will be required to make 4 ounces?

388.—Dover's Powder contains 10 per cent. of each of opium and ipecac, and the remainder is milk sugar. How much of each ingredient is required to make one pound?

389.—I want 120 Gm. of a 4 per cent. solution of sodium hyposulphite in water. How much of each must I use?

390.—One kilogram of a solution leaves, on evaporation, a residue of 125 Gm. of potassium bromide. What was the per cent. strength of the solution?

391.—What is the per cent. strength of a solution containing $2\frac{1}{2}$ ounces in 32 ounces?

392.—If one pound of jalap yield one ounce of resin, what is the per cent. of resin in the drug?

393.—If 5 Gm. of opium yield 666 milligrams of morphine, what is the morphine strength of that opium expressed in per cent.?

394.—If 25 pounds of a certain drug gives $\frac{3}{4}$ ℔ of solid extract, what is the yield expressed in per cent.?

395.—If it takes $3\frac{1}{8}$ ℔ of drug to make 11 ounces of its extract, what is the percentage yield?

396.—If 5 Gm. of cinchona bark gives 275 milligrams of total alkaloids, what percentage does that show?

397.—What percentage strength corresponds to "1 ounce to the pound"?

398.—If 573 Gm. contain 28.65 Gm. of active constituent, what is the percentage strength?

399.—If I dissolve 5 Gm. of cocaine hydrochlorate in 100 Gm. of water, what is the percentage strength of the resulting solution?

400.—What is the percentage strength of a mixture consisting of 6 ℔ of diluent and $\frac{1}{4}$ ℔ of active constituent?

401.—What is the percentage strength of a solution of 20 parts of salt in 100 parts of water?

402.—What is the percentage strength of a solution of 25 parts of salt in 100 parts of alcohol?

403.—I pour some tar into one pound of alcohol, and find combined weight of the two together to be 19 ounces; I then allow the tar to be dissolved, aiding the solution by shaking; what is the per cent. strength of the tar solution?

404.—What proportions of cocaine hydrochlorate and water are required to make one ounce of a 4 per cent. solution?

405.—What proportions of zinc sulphate and water are necessary to make 8 ounces of a 10 per cent. solution?

406.—How much of a 20 per cent. solution of sodium carbonate can be made of 20 Gm. of the salt?

407.—What amount of water must be added to 4 ounces of potassium iodide to make a 50 per cent. solution?

408.—What will be the percentage strength of a solution consisting of 25 Gm. potassium iodide and 100 Gm. water?

409.—If 1,000 grains of solution contain 400 grains of salt, what is the percentage strength of the solution?

410.—If 1,000 grains of salt solution contain 400 grains of water, what is the percentage strength of the solution?

411.—Aconite root yields about 16 per cent. solid extract to alcohol; how much extractive should be left upon evaporating 50 C.c. of the fluid extract?

412.—Socotrine aloes gives 22 per cent. water-extract; how much of the extract is equivalent to 9 grains aloes?

413.—How much ergot is required to make 100 Gm. of the official extract?

414.—How much tincture of hyoscyamus is equivalent to 15 C.c. of the fluid-extract?

415.—Belladonna leaf yields about 22 per cent. extractive to a 66 per cent. alcohol; how much solid extract is contained in 1 ounce of a 15 per cent. tincture made with that menstruum?

416.—Indian cannabis yields 13 per cent. alcoholic extractive; how much of the fluid-extract would be equivalent to 1 grain of the solid extract on that basis?

417.—If the average yield of extract from colocynth pulp be 33 per cent., and colocynth consists of 75 per cent. seed and 25 per cent. pulp, how much drug is required to make one pound compound extract of colocynth containing 16 per cent. of the simple extract?

418.—If digitalis yield 25 per cent. extractive to diluted alcohol, how much extractive is contained in the official tinture?

419.—Tincture of digitalis is 10 times the strength of the infusion, and the extract is 26 times the strength of the tincture; how much tincture, infusion, fluid extract, extract, and abstract, respectively, must be taken to represent 66 grains of the crude drug?

420.—How much extract of nux vomica ought to be obtained on evaporating 800 C.c. of the fluid extract?

421.—How much glycerin by volume is contained in 100 C.c. of the official fluid extract of krameria?

422.—Hyoscyamus yields 22 per cent. extractive to the official menstruum for its fluid extract; how much solid extract should remain upon evaporation of 40 C.c. of the fluid extract?

423.—*a*) What quantity of fluid extract of nux vomica corresponds in medicinal value to 10 Gm. of the tincture?

(*b*) and how much of the abstract is equivalent to 1 grain of the solid extract if the yield of solid extract from the crude drug be 12½ per cent.?

424.—If opium yield 60 per cent. extractive to diluted alcohol, what would be the amount of extractive in 60 grains of the tincture?

425.—If a moist opium containing 10 per cent. morphine be dried, and is found to lose 20 per cent. of moisture in drying, what will be the percentage of morphine in the dried opium?

426.—If the yield of solid extract from nux vomica be 12½ per cent., how much of the drug will be required to make 100 ounces of the extract?

427.—If the yield of resin of podophyllum be 4.50 per cent., how much mandrake will be required to make one pound of the resin?

428.—How much morphine is contained: *a*) in one ounce tincture of opium made from powdered opium containing 13½ per cent. morphine? *b*) in 1 Gm. tincture made from an opium containing 12 per cent. morphine?

429.—How much opium of 12 per cent. morphine strength and how much of 15 per cent. morphine strength must be taken to make: *a*) 1 pound opium containing 13½ per cent. morphine? *b*) 500 Gm. opium containing 14 per cent. morphine?

430.—Physostigma yields 3 per cent. extractive to the official alcohol, but 12 per cent. to a much weaker alcoholic menstruum; if the dose of the former extract be $\frac{1}{10}$ grain, what is the dose of the other, assuming that both menstrua will extract the whole of the active constituents?

431.—State the amount of solid extract yielded by 1

pound tincture of physostigma on the assumption that the crude drug yields 3 per cent. alcoholic extractive.

432.—How much fluid extract, tincture, and abstract of podophyllum, respectively, will be about equivalent to 1 Gm. of the resin?

433.—How much tincture of stramonium equals 10 C.c. of the fluid extract?

434.—How much ferric chloride (anhydrous) is contained in one drachm tincture of ferric chloride?

435.—If the dose of the tincture of veratrum viride is 6 grains, what is the dose of the fluid extract?

436.—How much tincture of aloes is equivalent to 10 grains of the drug?

437.—How much tincture of opium represents 1 grain of powdered opium?

438.—How much camphorated tincture of opium represents 1 grain of opium?

439.—How much arsenous oxide is represented by 20 minims of Fowler's solution?

440.—How much glycerin and how much extractive are contained in tincture of nutgall, the drug yielding 60 per cent. of extractive to diluted alcohol?

441.—If nux vomica contain 3 per cent. total alkaloids, what should be the amount of total alkaloids found in: *a*) 1 ounce of the official tincture? *b*) 10 grains of the official extract? *c*) 1 fluid-drachm of the fluid extract?

442.—Assuming that aconite root contains 0.50 per cent. alkaloids, that the yield of alcoholic extract is 16 per cent., and that the initial adult dose of that extract is $\frac{1}{8}$ grain; and assuming further that aconite leaf con-

tains 0.05 per cent. total alkaloids and yields 20 per cent. extract; what will be the initial dose of extract of aconite leaf?

Enumerate the materials and state what quantity of each is required for preparing:—

443.—5 pounds ointment.

444.—1 pound mucilage of acacia.

445.—1 pound mucilage of tragacanth.

446.—2 ounces chloroform mixture.

447.—4 ounces Dover's powder.

448.—500 Gm. compound rhubarb powder.

449.—2 pounds syrup of rhubarb.

450.—1 pound aromatic syrup of rhubarb.

451.—500 Gm. cantharidal cerate.

452.—1 pound cerate.

453.—1 pound adhesive plaster.

454.—8 ounces infusion of digitalis.

455.—4 ounces compound infusion of senna.

456.—1 pound liniment of ammonia.

457.—2 pounds ointment of zinc oxide.

458.—4 ounces oleate of mercury.

459.—1 pound massa hydrargyri.

460.—4 ounces cold cream.

461.—1 ounce iodine ointment.

PART VII.

ALLIGATION IN PHARMACEUTICAL PROBLEMS.

Rule I.—To find the value of any mixture of known quantities of ingredients, each of known value:—*Multiply the quantity of each ingredient by its value and add the several products; divide the sum by the sum of the quantities of the several ingredients; the quotient is the value of the whole mixture.*

Ex.—We mix 3 ℔ of 80% alcohol, 8 ℔ of 91% alcohol, 5 ℔ of 45.5% alcohol, 6 ℔ of 40% alcohol, and 8 ℔ of water; what will be the alcoholic percentage strength of the mixture?

$$\begin{array}{rl} 3\times 80 & = 240. \\ 8\times 91 & = 728. \\ 5\times 45.5 & = 227.5 \\ 6\times 40 & = 240. \\ 8\times 0 & = 0. \\ \hline 30 & 1435.5 \end{array}$$

$$\text{and } \frac{1435.5}{30} = 47.85\%$$

Rule II.—To find the proportional quantities of ingredients of known value required to produce a given mean value:—*Write the numbers expressing the units of value of the respective ingredients in a column to the right, and the mean sought, to the left; link together the*

numbers expressing the respective values of any two ingredients, one of which is above and the other below the mean value sought; take the difference between the mean and the value of each ingredient, and place that difference opposite the value of the other ingredient to which it is linked: the differences are the proportions required of the ingredients opposite whose values they are placed. Thus:—

14	9	2	=18
	12	4	=48
	13	2	=26
	16	1+5	=96
	18	2	=36
		11+5=16	224 | 14
			16
			64
			64

In the example above shown, we have 5 ingredients, one of the value of 9, another 12, another 13, another 16, and the fifth of 18; these 5 different ingredients are to be combined in such a manner as to produce a mixture of a mean value of 14. The first ingredient, having a value of 9 (which is a value below 14), is linked to the fourth ingredient, having the value of 16 (which is above 14). The second ingredient, with the value of 12, is linked to the fifth, with the value of 18; and the third ingredient, having a value of 13, is linked to the fourth in the same manner. As the difference between 13 and 14 is 1, we place the number 1 opposite 16, to which the 13 is linked; and as the difference between 14 and 16 is 2, we place the number 2 opposite the 13 to which the

16 is linked. Then taking another pair, we put the number 4 opposite 12, because 12 is linked to 18, and the difference between 14 and 18 is 4; and opposite 18, which is linked to the 12, we put the number 2, which is the difference between 14 and 12. One more pair now remains, viz.: that of 9 and 16. Opposite 9 we put the number 2, because 2 is the difference between 14 and 16 to which 9 is linked; and opposite 16 we put the number 5 (in addition to the number 1 already placed opposite 16), because 5 is the difference between 14 and 9. Now we add together the numbers set opposite the ingredients, which are 11+5, making the total 16 parts. In other words, we must use 2 parts of the ingredient represented by 9; four parts of the ingredient having the value of 12; 2 parts of the third ingredient; 1+5, or 6 parts of the fourth ingredient, and 2 parts of the fifth, making 16 parts in all, and we will find that this mixture will have a mean value of 14.

Explanation:—Let us assume that the numbers 9, 12, 13, 16 and 18 represent percentage of strength; that, for instance, we have five different kinds of opium, one containing 9 per cent. morphine; the second 12 per cent.; the third 13 per cent.; the fourth 16 per cent.; and the fifth 18 per cent. of morphine, and we desire to mix these several kinds of opium in such a way as to produce an opium of 14 per cent. morphine. Now, as twice 9 per cent. is 18 per cent.; 4 times 12, 48 per cent.; twice 13 is 26; 6 times 16, 96; and twice 18 is 36 per cent., the total per cent. units will be 224, which, if divided by 16, gives us a mean of 14 as the quotient.

It is obvious that the preceding example just described may be solved in various other ways. Thus,

for instance: We may link the 9 to the 18, instead of to the 16; we may link the 16 to the 12, instead of to the 13; and we may link the 13 to the 18, instead of to the 16. If we proceed in that manner the proportions of the ingredients will be somewhat different, but the final result, as to the mean value sought, will be the same. Thus:—

$$\begin{array}{c|l|c|l}
 & 9 & 4 & = 36 \\
 & 12 & 2 & = 24 \\
14 & 13 & 4 & = 52 \\
 & 16 & 2 & = 32 \\
 & 18 & 5+1 & = 108 \\
\end{array}$$

$$\begin{array}{r|r|l}
17+1=18 & 252 & 14 \\
 & 18 & \\
\hline
 & 72 & \\
 & 72 & \\
\hline
\end{array}$$

As 9 is linked to 18, we will require 4 parts of the 9 per cent. opium, since the difference between 14 and 18 is 4. We will require at the same time 5 parts of the 18 per cent. opium, since the difference between 14 and 9 is 5. If 4 parts of 9 per cent. opium be mixed with 5 parts of 18 per cent. opium, we will have:—

$$\begin{array}{ll}
4\times\ 9=36 & \\
5\times 18=90 & \\
\hline
9 \qquad\quad 126 & \text{and } \frac{126}{9}=14
\end{array}$$

Then as 12 is linked to 16, we will require 2 parts of each of these 2 ingredients to obtain a mean value of 14 per cent., for:—

$$\begin{array}{ll}
2\times 12=24 & \\
2\times 16=32 & \\
\hline
4 \qquad\quad 56 & \text{and } \frac{56}{4}=14
\end{array}$$

Next we deal with 13 and 18, which are linked together as the third pair. We will require 4 parts of the 13 per cent. opium, because the difference between 14 and 18 is 4; and we will require 1 part of the 18 per cent. opium, because the difference between 14 and 13 is 1, for:—

$$\begin{array}{l} 4\times 13=52 \\ \underline{1\times 18=18} \\ 5 \qquad\quad 70 \end{array} \text{ and } \frac{70}{5}=14$$

Since the mean produced by any one of the three pairs of ingredients in the proportion given above is 14, the mean of all of them will, of course, also be 14. As will be seen, the total number of parts of the five different kinds of opium is 18; and the percentages multiplied by these parts aggregate 252; and the total per cent. divided by the total number of parts produces the mean percentage 14.

DILUTION AND FORTIFICATION.

Rule III. To dilute or fortify any number of parts of any ingredient of given value, so as to produce any other given value:—*First find the relative quantities required of the ingredients, by Rule II, and then use proportion to ascertain the actual quantities required.* Thus:—Referring again to the first example, already given (under Rule II.), suppose we have 50 pounds of opium of 9 per cent. strength, and wish to fortify that opium with richer opiums to produce the average of 14, and we have for that purpose opiums of 12, 13, 16 and 18 per cent. respectively; then, knowing that 2 pounds

of 9 per cent. opium will require 4 pounds of 12 per cent., 2 pounds of 13 per cent., 6 pounds of 16 per cent., and 2 pounds of 18 per cent., we can easily compute, by means of proportion, how much of each of the several stronger opiums will be required to fortify 50 pounds of 9 per cent. opium to give it a mean of 14 per cent.

In the second example (under Rule II.), we found that 4 pounds of 9 per cent. opium required 2 pounds of 12 per cent. opium, 4 pounds of 13 per cent., 2 pounds of 16 per cent., and 6 pounds of 18 per cent. opium to produce 18 pounds of 14 per cent. opium; and we can readily find, by means of proportion, how much of either of the other ingredients will be required to convert any number of pounds of 9 per cent. opium into a 14 per cent. opium, and can at the same time compute the total quantity of 14 per cent. opium thus produced.

N. B.—One common unit of quantity and one common unit of value must be used for each ingredient, and also for the whole mixture.

"Value" may stand for percentage strength, specific weight, specific volume, money value, or any other kind of value.

RULE IV. Having a known quantity of one ingredient of known value, and desiring to find the required quantity of the second ingredient of known value which must be used to produce a mixture of any desired mean value:—*Multiply the known quantity of the first ingredient by the difference between its value and the value desired; divide the product by the difference between the value of the second ingredient and the desired value of the mixture. The quotient is the quantity required of the second ingredient.*

Formula:—Let the known quantity of the first ingredient be called a; the difference between its value and the value desired, b; the difference between the value of the second ingredient and the value desired, c; and the quantity required of the second ingredient, x.

Then:— $\frac{a \times b}{c} = x.$

Ex. I.—Suppose we have two ingredients, one of them of 90 per cent. value and the other 40 per cent., and desire to mix 10 pounds of the 90 per cent. ingredient with such an amount of the 40 per cent. ingredient as to produce a mean of 60 per cent.

Then:— $\frac{10 \times 30}{20} = 15$, and therefore we will require 15 pounds of the 40 per cent. ingredient.

Proof:—

$$
\begin{array}{lr|c}
10 \times 90 = & 900 & \\
15 \times 40 = & 600 & 25 \\
\hline
25 & 1500 & \overline{60} \\
 & 150 & \\
\cline{2-2}
 & 00 & \\
 & 00 &
\end{array}
$$

Ex. II.—Suppose we have 10 pounds of an ingredient of 100 per cent. strength, and wish to dilute it to 50 per cent. strength. How much of a diluent of 0 per cent. strength is necessary?

$$\frac{10 \times 50}{50} = 10$$

Proof:—

$$
\begin{array}{lrr|l}
10\times & 100= & 1000 & \\
10\times & 0= & 0 & \\
\hline
20 & & 1000 & 20 \\
 & & 100 & \overline{50} \\
\cline{3-3}
 & & 00 & \\
 & & 00 & \\
\end{array}
$$

Ex. III.—Suppose we want to make a mixture of 40 per cent. strength out of 30 pounds of a diluent of 0 per cent. strength, by adding an ingredient of 100 per cent. strength.

Then:—

$$\frac{30\times 40}{60}=20$$

Proof:—

$$
\begin{array}{lrr|l}
30\times & 0= & 0 & \\
20\times & 100= & 2000 & \\
\hline
50 & & 2000 & 50 \\
 & & 200 & \overline{40} \\
\cline{3-3}
 & & 00 & \\
 & & 00 & \\
\end{array}
$$

Ex. IV.—We have 10 pounds of a solution of 30 per cent. strength. How much water must be added to reduce it to 7 per cent.?

$$\frac{10\times 23}{7}=\frac{230}{7}=32\tfrac{6}{7}\text{ lb}$$

Proof:—

$$
\begin{array}{c|rrr|l}
7 & 30\times & 7= & 210 & \\
 & 0\times & 23= & 0 & 7 \\
\hline
 & & 30 & 210 & \overline{30} \\
\end{array}
$$

$$7:10::30:x.$$
$$x=42\tfrac{6}{7}\text{ lb.}$$

x is the number of pounds ($42\frac{6}{7}$) of 7 per cent. solution produced by 10 pounds of the 30 per cent. solution; the difference is the number of pounds of water required ($32\frac{6}{7}$ ℔).

Ex. V.—We have 20 pounds of a glycerin solution containing 7 per cent. of glycerin. We want to add to it enough glycerin to increase the strength to 30 per cent. How much glycerin must be added?

$$\frac{20\times 23}{70}=\frac{460}{70}=6\tfrac{4}{7}$$

Proof:—

$$\begin{array}{r|rcr|c} 30 & 7 \times 70 & = & 490 & 93 \\ & 100\times 23 & = & 2300 & \overline{} \\ & \overline{93} & & \overline{2790} & 30 \\ & & & 279 & \end{array}$$

$$70 : 20 :: 93 : x.$$
$$x = 26\tfrac{4}{7},$$

which is the number of pounds of 30 per cent. glycerin produced by adding $6\frac{4}{7}$ ℔ glycerin to 20 ℔ of a mixture of glycerin and water containing 7 per cent. of glycerin.

462.—If we mix $\frac{1}{2}$ pound of opium containing $17\frac{1}{2}$ per cent. morphine, one pound of opium containing $12\frac{1}{2}$ per cent. morphine, and 6 ounces of opium containing 15 per cent. morphine, what will be the percentage of morphine of the whole mixture?

463.—If we mix 2 pounds of powdered cinchona bark containing 8 per cent. total alkaloids, and 3 pounds of powdered cinchona containing 4 per cent. total

alkaloids, what will be the percentage of alkaloids of the mixture?

464.—If one pound of a solution of 1.200 specific weight be mixed with one pound of water, what will be the specific weight of the mixture?

465.—If a salt solution of 10 per cent. strength be mixed with an equal weight of another solution of the same salt, but of 20 per cent. strength, what will be the strength of the mixture?

466.—How much water must be added to a solution of the specific weight 1.400, to reduce the specific weight to 1.200?

467.—How much official water of ammonia containing 10 per cent. of the gas NH_3, can be made from 10 pounds of the official "stronger water of ammonia" which contains 28 per cent. of NH_3?

468.—How much official diluted acetic acid can be made from the official "glacial acetic acid"?

469.—How much water must be added to one pound official acetic acid, to reduce it to a 4 per cent. acid?

470.—How much official glacial acetic acid is required to make 2 pounds of the official diluted acetic acid?

471.—How much official "stronger water of ammonia" is required to make 10 pounds of a 10 per cent. solution of ammonia?

472.—How much diluent must be added to a 70 per cent. solution, to reduce it to a 30 per cent. solution?

473.—How much water must be added to the official solution of tersulphate of iron, to reduce its strength so that it contains 10 per cent. of the ferric sulphate?

474.—What quantities of water and of official

solution of chloride of iron are required to make one pound of a 10 per cent. solution of ferric chloride?

475.—How much "potassa" containing 90 per cent. of potassium hydrate will be required to make 5 pounds of a solution containing 50 per cent. of the hydrate?

476.—How much solid matter will remain upon evaporating 200 ounces of the official solution of subsulphate of iron to dryness?

477.—We have ingredients of 10 per cent., 13 per cent., and 20 per cent. strength, respectively. We want a mixture of 15 per cent. What proportions must be used?

478.—We have 10 pounds of 20 per cent. strength and any quantity that may be required of 10 per cent., and 13 per cent., respectively. Wishing to use the whole 10 pounds of 20 per cent. strength to make a mixture of 15 per cent., how much must be used of each of the other two?

479.—We have ingredients of 10 per cent., 13 per cent., and 20 per cent., respectively. We want 20 pounds of a mixture containing 15 per cent. What quantities shall we use of each of the three ingredients?

480.—If we have a sufficient supply of diluted acetic acid and glacial acetic acid, what proportions of these two must be mixed to produce the official "acetic acid"?

481.—How much sugar of milk must be used as a diluent to reduce an opium of 16 per cent. strength, to a mixture containing 12½ per cent. morphine?

482.—Having three lots of jalap containing, respectively, 16 per cent., 13 per cent., and 9 per cent., and wishing to produce a mixture containing 12½ per cent., what proportions must be used?

483.—Having five lots of resin of scammony containing, respectively, 78, 82, 88, 89, and 91 per cent. of resin, in what proportions must they be combined to produce a mixture of 80 per cent.?

484.—In making tincture of nux vomica, by percolation, I find that the total percolate obtained by exhausting the drug, assays 2.75 per cent. solid extract. How much alcohol must be added to reduce it to 2 per cent.?

485.—How much jalap of 10 per cent. must be mixed with jalap of 16 per cent. to make one pound of jalap of 12 per cent.?

486.—Having two lots of powdered cinchona of 2 per cent. and 7 per cent., respectively, how shall I mix them to make one pound of a mixture of 5 per cent.?

487.—How much water must be added to reduce a 40 per cent. solution of chloride of iron to the official standard strength?

488.—How much water must be added to a water solution of 1.350 sp. w., to reduce it to 1.26 sp. w.?

PART VIII.

DILUTION AND FORTIFICATION OF ALCOHOL.

RULE I.—To find the quantity of water required to be added to alcohol of any given percentage strength, to dilute it to any other percentage strength desired:—*Divide the per cent. strength of the alcohol to be diluted* (a) *by the percentage desired* (b), *and subtract 1 from the quotient; the remainder is the number of parts of water* (x) *to be added to each part of the alcohol used to produce the result desired.*

$$\frac{a}{b}-1=x.$$

Ex.:—We have a 90 per cent. alcohol to be diluted to 60 per cent.:—

$$\frac{90}{60}=1.50, \text{ and } 1.50-1=0.50.$$

Therefore: ½ pound of water is to be added to 1 pound of the 90 per cent. alcohol to reduce it to 60 per cent.

RULE II.—To dilute official "alcohol" (91 per cent.) to any given lower per cent. strength:—*Divide 91 by the per cent. desired and subtract 1 from the quotient; the remainder is the number of pounds of water to be added to each pound of alcohol.*

RULE III.—To make the official "diluted alcohol" (U. S. P., 1880) from any stronger alcohol:—*Divide the per cent. strength of the alcohol to be diluted by 45.5 and subtract 1 from the quotient; the remainder is the number of pounds of water to be added to each pound of alcohol used.*

RULE IV.—To reduce a given quantity of alcohol of any given per cent. strength, to any lower per cent. strength desired:—*Multiply the weight of the alcohol by its per cent. strength; divide by the per cent. desired; the quotient is the total weight to which the alcohol must be diluted with water, in order to reduce it to the per cent. strength desired; and the difference between that quotient and the original weight of the alcohol used, is the weight of water required for the dilution.*

RULE V.—To make a definite quantity, by weight, of alcohol of any given per cent. strength from any stronger alcohol:—*Multiply the required quantity* (*a*) *by the desired per cent.* (*b*) *and divide by the per cent. strength of the stronger alcohol used* (*c*); *the quotient is the weight of stronger alcohol required* (*d*) *to be diluted with water; and the difference between that weight* (*d*) *and the weight of the diluted alcohol desired* (*a*) *is the weight of water* (*e*) *necessary for the dilution.*

$$\frac{a \times b}{c} = d, \text{ and } d + e = a.$$

Ex.:—6 pounds of 60 per cent. alcohol is to be made from an alcohol of 90 per cent. strength:

$$\frac{6 \times 60}{90} = 4, \text{ and } 4 + 2 = 6.$$

RULE VI.—To mix a stronger and a weaker alcohol so as to produce any given strength:—*Use alligation as explained in Rule II on pages 38 to 42.*

RULE VII.—To make any given quantity of alcohol of any desired per cent. strength by mixing a stronger and a weaker alcohol:—*Use alligation as explained in Rule III on page 42.*

RULE VIII.—To dilute or fortify any given weight of alcohol of any per cent. strength, by an alcohol of different strength, or by water, so as to produce a mixture of any desired strength:—*Use Rule IV on pages 43 to 46.*

N. B.—The answers obtained by any of the preceding eight rules are exact, provided one common unit of quantity, by weight, is employed in any problem, and provided the per cent. strength is always by weight.

Whenever any number of *volumes* are to be mixed, instead of weights, and whenever the percentage strength of the alcohol is expressed by *volume*, the answers are not quite exact, because when alcohol and water are mixed, a contraction of volume takes place, so that in diluting a stronger alcohol with the quantity of water found to be required in accordance with the foregoing rules, the total volume produced will be less than the calculation requires; and in order to produce a correct result, it will then be necessary to add enough water to make up the required volume, and at the same time the correct percentage strength.

489.—How much water must be added to 4 ℔ of alcohol of 91 per cent. strength to reduce it to 66 per cent.?

490.—How much water must be added to 10 ℔ of 84 per cent. alcohol to reduce it to 50 per cent.?

491.—How much water must be added to 8 ℔ of 80 per cent. alcohol to reduce it to 45.5 per cent.?

492.—How much water must be added to the official alcohol to reduce it to 60 per cent.?

493.—How much water must be added to 10 ℔ of 90 per cent. alcohol to make the official diluted alcohol out of it?

494.—How would you produce official diluted alcohol out of 8 ℔ alcohol of 84 per cent. strength?

495.—How would you reduce 50 ℔ of alcohol of 78 per cent. strength to 60 per cent.?

496.—How shall 1 ℔ of alcohol of 68 per cent. strength be reduced to 47 per cent.?

497.—How would you reduce 1 kilogram of alcohol of 88 per cent. strength to 70 per cent.?

498.—How would you make 10 ℔ of alcohol of 60 per cent. strength out of 91 per cent. alcohol and water?

499.—How would you make 8 ℔ of 45.5 per cent. alcohol out of 85 per cent. alcohol?

500.—How much 90 per cent. alcohol is necessary to make 2 kilograms of 80 per cent. alcohol?

501.—How much 70 per cent. alcohol is required to make 10 ℔ of 40 per cent. alcohol?

502.—In what proportions must 91 per cent. alcohol and 30 per cent. alcohol be mixed to produce a mixture of 50 per cent. strength?

503.—We have several lots of alcohol of 88%, 85%, 76%, and 68%, respectively; in what proportions must they be mixed to produce a mixture of 84% strength?

504.—How shall I make 5 kilograms of 75 per cent. alcohol out of 91 per cent. alcohol and 34 per cent. alcohol?

505.—How much water must be added to 10 ℔ of alcohol of 90 per cent. strength to produce an alcohol of 86 per cent.?

506.—How much 91 per cent. alcohol must be added to 10 ℔ of water to produce an alcohol of 88 per cent. strength?

507.—How much alcohol of 91 per cent. strength must be added to 25 kilograms of alcohol of 48 per cent. strength to produce a mixture of 67 per cent. strength?

508.—How much alcohol of 84 per cent. strength must be added to 10 ℔ of alcohol of 42 per cent. strength to produce a mixture having 45.5 per cent. strength?

509.—State the percentage alcoholic strength of a mixture of 1 part 60 per cent. alcohol and 2 parts water.

510.—State the percentage alcoholic strength of a mixture of 2 parts official alcohol and 1 part water.

511.—How much alcohol of 40 per cent. strength can be made from 1,000 Gm. of alcohol of 80 per cent. strength?

512.—How many parts alcohol of 80 per cent. strength can be made from 80 parts alcohol of 91 per cent. strength?

513.—How much water is required to dilute an alcohol of 50 per cent. strength, to one of 45.5 per cent.?

514.—How many parts of alcohol of 45.5 per cent. strength can be made from 45.5 parts of alcohol of 91 per cent. strength?

515.—What proportions of official alcohol and official diluted alcohol must be used to produce an alcohol of 85 per cent. strength?

516.—How much official alcohol must be added to

10 pounds of water to produce a mixture containing 50 per cent. absolute alcohol?

517.—How much alcohol of 91 per cent. strength must be added to 100 parts of alcohol of 60 per cent. strength, in order to produce a mixture of 80 per cent. strength?

518.—How much alcohol of 91 per cent. strength is required to make one pound of alcohol of 66 per cent. strength?

PART IX.

FORMULAS EXPRESSED IN PARTS BY WEIGHT, REDUCED TO FORMULAS FOR DEFINITE QUANTITIES, AND VICE VERSA.

PREPARATIONS OF THE U. S. PHARMACOPŒIA, 1880.

519.—Diluted acetic acid is directed to be made from 17 parts acetic acid and 83 parts water. Write the formula for making 32 ounces.

520.—Benzoate of lard, U. S. P., 1880, is prepared from 2 parts benzoin to each 100 parts of lard, making 100 parts of finished product. Write the formula for making one pound.

521.—Cerate is made of 30 parts white wax and 70 parts lard. What quantities are required for making one pound?

522.—Cantharides cerate is made of 35 parts cantharides, 20 parts yellow wax, 20 parts resin, and 25 parts lard. Write the formula for 5 pounds.

523.—7 pounds resin, 3 pounds yellow wax, and 10 pounds lard, mixed together, will make the official resin cerate. Write the formula in parts by weight, for 100 parts.

524.—100 parts belladonna plaster are made from 100 parts belladonna root. How much belladonna root will be required to make one pound of plaster?

525.—8 ounces yellow wax and 72 ounces Burgundy pitch, melted together, form Burgundy pitch plaster. Write the formula in parts by weight for 100 parts.

526.—Adhesive plaster consists of 14 parts resin, 80 parts lead plaster and 6 parts yellow wax. What quantities of ingredients are required to make 2 pounds?

527.—The materials necessary to make compound extract of colocynth, are: 16 parts extract of colocynth, 50 parts aloes, 6 parts cardamom, 14 parts resin of scammony, 14 parts soap, and 10 parts alcohol. Write the formula giving quantities required for one pound.

528.—Mercury mass consists of 33 parts mercury, 5 parts glycyrrhiza, 25 parts althæa, 3 parts glycerin, and 34 parts honey of rose. What quantities of these materials are required for making 50 ounces?

529.—Pills of aloes contain 2 grains aloes and 2 grains soap each. Write the formula in parts by weight for a sufficient amount of the mass to make 12 pills.

530.—Compound cathartic pills contain, each, 84 milligrams compound extract of colocynth, 65 milligrams abstract jalap, 65 milligrams calomel, and 16 milligrams gamboge. What number of parts of each ingredient is necessary to make 100 parts of the mass?

531.—Each compound pill of rhubarb contains 130 milligrams rhubarb, 97.5 milligrams purified aloes, 65 milligrams myrrh, and 6.5 milligrams oil of peppermint. Write the formula for such a quantity of the mass, that when it is divided into 100 equal parts, each pill will be of the requisite size.

532.—Antimonial powder consists of 33 parts oxide of antimony and 67 parts precipitated calcium phosphate. What quantities are required to make 250 Gm.?

533.—Aromatic powder consists of 7 ounces cinnamon, 7 ounces ginger, 3 ounces cardamom, and 3 ounces nutmeg. Write the formula for 100 parts by weight.

534.—Compound chalk powder consists of 3 parts prepared chalk, 2 parts acacia, and 5 parts sugar. What quantities of these materials are required to make 1 pound?

535.—One Seidlitz powder contains 40 grains sodium bicarbonate, 120 grains Rochelle salt, and 35 grains tartaric acid. Write the formula for 1 Seidlitz powder in parts by weight.

536.—Compound glycyrrhiza powder consists of 9 parts senna, 8 parts glycyrrhiza, 4 parts fennel, 4 parts washed sulphur, and 25 parts sugar. What number of grains of each ingredient is contained in 1 ounce?

537.—Dover's powder contains 10 per cent. ipecac, 10 per cent. opium, and 80 per cent. milk sugar. Write the formula in parts by weight for 4 ounces.

538.—12 troches of glycyrrhiza and opium contain together 2400 grains of extract of glycyrrhiza, 60 grains extract of opium, 2400 grains acacia, 3600 grains sugar, and 36 grains oil of anise. Write the formula in parts by weight for a sufficient quantity of the mass to make 100 troches.

539.—A mass for making 100 troches of chlorate of potassium, consists of 500 parts potassium chlorate, 1900 parts sugar, 100 parts tragacanth, and 10 parts spirit of lemon, Write the formula in Gm. for 50 troches.

540.—Ointment of belladonna consists of 10 per cent. extract of belladonna, 6 per cent. diluted alcohol, 84 per cent. benzoinate of lard. Write the formula for 1 ounce.

541.—Iodoform ointment contains 48 grains iodoform, and 432 grains benzoinate of lard in each ounce. Write the formula for iodoform ointment in parts by weight.

PART X.

THERMOMETRIC SCALES.

The freezing point on the Centigrade thermometer is at 0, and the boiling point at 100.

The freezing point on Fahrenheit's thermometer is at +32, and the boiling point at +212.

On Reaumur's thermometer the freezing point is at 0, and the boiling point at 80.

Rules for Converting:—

1. To reduce Centigrade degrees to those of Fahrenheit:—*Multiply by 9 and divide by 5; and then add 32.*

2. To reduce Fahrenheit's degrees to those of Centigrade:—*Subtract 32, multiply the remainder by 5, and divide the product by 9.*

3. To reduce Reaumur's degrees to those of Fahrenheit:—*Multiply by 9, divide by 4, and add 32.*

4. To reduce Fahrenheit's degrees to those of Reaumur:—*Subtract 32, multiply by 4, and divide by 9.*

5. To reduce Reaumur's degrees to Centigrade:—*Multiply by 5, and divide by 4.*

6. To reduce Centigrade degrees to Reaumur's:—*Multiply by 4, and divide by 5.*

7. To reduce positive Centigrade degrees to Absolute Temperature:—*Add 273.* (See pages 63 and 64.)

8. To reduce negative Centigrade degrees to Absolute Temperature:—*Deduct the Centigrade degrees from 273.* (See pages 63 and 64.)

9. To reduce Fahrenheit and Reaumur degrees to Absolute Temperature:—*First reduce to Centigrade; then follow rule 7 or 8.*

"Absolute temperature" is the temperature counted upward from *absolute zero* (which is equal to —273°C). It is expressed in degrees each of which has the same value as each degree of the Centigrade scale. Hence 0°C. is equal to 273° absolute temperature, and 100°C. is equal to 373° absolute temperature. See Part XI, pages 63 and 64 for explanation.

542.—Reduce — 40°C. to F.
543.—Reduce + 40°C. to F.
544.—Reduce +104°F. to C.
545.—Reduce + 10°C. to F.
546.—Reduce + 80°C. to F.
547.—Reduce + 95°F. to C.
548.—Reduce +120°C. to F.
549.—Reduce +120°F. to C.
550.—Reduce +194°F. to C.
551.—Reduce + 32°C. to F.
552.—Reduce + 77°F. to C.
553.—Reduce + 68°F. to C.
554.—Reduce + 60°R. to F.
555.—Reduce + 60°F. to R.
556.—Reduce + 60°C. to R.
557.—Reduce + 10°R. to C.
558.—Reduce + 15°C. to R.
559.—Reduce +300°C. to F.
560.—Reduce +140°F. to C.

561.—Reduce + 70°C. to F.

562.—Reduce + 17°C. to F.

563.—Reduce + 15°C. to F.

564.—Reduce + 15°F. to C.

565.—Reduce +600°F. to C.

566.—Reduce + 20°F. to C.

567.—Reduce +180°F. to C.

568.—Reduce + 10°F. to C.

569.—Reduce + 20°C. to F.

570.—Reduce + 4°C. to F.

571.—Reduce + 32°F. to C.

572.—Reduce + 15°C. to Absolute Temperature.

573.—Reduce + 20°C. to Absolute Temperature.

574.—Reduce + 4°C. to Absolute Temperature.

575.—Reduce — 10°C. to Absolute Temperature.

PART XI.

CHANGES OF VOLUME OF GASES UNDER CHANGES OF TEMPERATURE AND PRESSURE.

TEMPERATURE.

The co-efficient of expansion of gases under change of temperature is $\frac{1}{273}$ (or 0.0036630) for each degree at 0°C. For each degree F. the co-efficient of expansion is $\frac{1}{491}$ (or 0.002037) at 32°F. This means that the volume of a gas is increased by $\frac{1}{273}$, or 0.0036630, when the temperature is raised one degree by the Centigrade thermometer, and that its volume is diminished by $\frac{1}{273}$, or 0.0036630, when the temperature is decreased one degree by the Centigrade thermometer; or that 273 volumes of any gas at 0°C. will occupy 274 volumes at 1°C., and 275 volumes at 2°C.; or will occupy 272 volumes at —1°C., or 271 volumes at —2°C.

In the same manner, the volume of a gas at 32°F. is increased by $\frac{1}{491}$ (or 0.002037) when its temperature is raised one degree by Fahrenheit's thermometer, and its volume diminished by $\frac{1}{491}$ (or 0.002037) for each degree F. of increase in temperature, so that 491 volumes at 32°F. will become 492 volumes at 33°, and 501 volumes at 42°, and will occupy only 490 volumes at 31°, and 480 volumes at 22°F.

Hence, knowing the volume of any mass of a gas at any given temperature, its volume at any other temperature may be calculated by the co-efficient of expansion.

Let the temperature be expressed in absolute degrees. Then use the following:—

RULE.—*Multiply the known volume of the gas by the new temperature, and divide the product by the old temperature.*

As zero by the Centigrade thermometer represents 273° absolute temperature, any number of degrees below zero must be deducted from 273 to obtain the absolute temperature; and any number of degrees C. above zero must be added to 273 to obtain the absolute temperature. (See Part X, pages 60 and 61.) Hence, if we designate as a the known volume of the gas, as b the absolute temperature at which it has that volume, as c the new absolute temperature at which its volume is sought to be ascertained, and as x the volume at the new absolute temperature, or, in other words, the volume sought, then:

$$\frac{a \times c}{b} = x.$$

EXAMPLES:—

I.—A gas occupies 100 C.c. at 0°C.; what volume will it occupy at 10°C.?

II.—A gas occupies 100 C.c. at 10°C.; what volume will it occupy at 20°C.?

III.—A gas occupies 100 C.c. at —10°C.; what volume will it occupy at 0°C.?

IV.—A gas occupies 100 C.c. at 0°C.; how many C.c. will it occupy at —10°C.?

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

V.—A gas occupies 100 C.c. at —10°C.; how many C.c. will it occupy at —20°C.?

VI.—A gas occupies 100 C.c. at +10°C.; how many C.c. will it occupy at —10°C.?

VII.—A gas occupies 100 C.c. at —10°C.; how many C.c. will it occupy at +10°C.?

SOLUTIONS:—

$$\text{I.}—\frac{100\times 283}{273}=\frac{28,300}{273}=103.66+.$$

$$\text{II.}—\frac{100\times 293}{283}=\frac{29,300}{283}=103.61+.$$

$$\text{III.}—\frac{100\times 273}{263}=\frac{27,300}{263}=103.80+.$$

$$\text{IV.}—\frac{100\times 263}{273}=\frac{26,300}{273}=96.33+.$$

$$\text{V.}—\frac{100\times 253}{263}=\frac{25,300}{263}=96.19+.$$

$$\text{VI.}—\frac{100\times 263}{283}=\frac{26,300}{283}=92.93+.$$

$$\text{VII.}—\frac{100\times 283}{263}=\frac{28,300}{263}=107.60+.$$

[When the temperatures are given in degrees of the Fahrenheit scale, they may be transposed, first to Centigrade degrees and then to absolute temperature, after which the same rule is applied as given in the foregoing.]

PRESSURE.

According to the law of Boyle the volume of the same mass of any gas varies inversely with the pressure to which it is subjected, provided the temperature re-

mains constant; or, which is the same, the density of a gas varies directly as the pressure.

A gas under a pressure of two atmospheres, measures one-half as much in volume as when under the pressure of one atmosphere, and 100 volumes of gas under the pressure of two atmospheres will become 200 volumes under the pressure of one atmosphere. Hence, knowing the volume of a given mass of any gas at a given pressure, we may compute its volume under any other pressure, by this

RULE:—*Multiply the known volume by the known pressure, and divide by the pressure at which the volume is sought to be ascertained.* Thus:

If a gas measures 10 volumes at 760 mM. pressure, it will measure 10.13+ volumes at 750 mM. pressure; because,

$$\frac{10\times760}{750}=10.13+.$$

The change of volume which takes place under a change of both temperature and pressure is, of course, computed upon the same principles, combining the two rules already given. Thus:—

The known volume is multiplied by the pressure under which a gas occupies that volume, and also by the new (absolute) temperature at which the changed volume is to be ascertained; this product is then divided by the new pressure multiplied by the old (absolute) temperature at which the gas occupied its original volume under the pressure stated.

Ex.: If a gas occupies 100 C.c. under 760 mM. pressure at a temperature of 0° C., we will find the volume it

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

occupies under the pressure of 800 mM. at a temperature of 10°C. as follows:—

$$\frac{100\times760\times283}{800\times273}=98.47+.$$

The rules already given may be represented more conveniently by the following formulas, in which

V=the old volume.

v=the new volume.

T=the old absolute temperature.

t=the new absolute temperature.

P=the old pressure.

p=the new pressure.

Rule I.—To find the change of volume resulting from changed pressure:

$$\frac{V\times P}{p}=v.$$

Rule II.—To find the change of volume resulting from change of temperature:

$$\frac{V\times t}{T}=v.$$

Rule III.—To find the change of volume resulting from change of both temperature and pressure:

$$\frac{V\times P\times t}{p\times T}=v.$$

576.—If a gas occupies 275 volumes at 2°C., how many volumes will it occupy at 0°C.?

577.—If a given mass of gas occupies 80 C.c. at 15°C., how many C.c. will it occupy at 50°C.?

578.—If a given mass of gas occupies 10 C.c. at 0°C., how many C.c. will it occupy at 212° F.?

579.—If a gas occupies one volume at 100°C., how many volumes will it occupy at —10°C.?

580.—If a given mass of gas occupies 50 volumes under 760 mM. pressure, how many volumes will it occupy under 756 mM. pressure?

581.—If a given mass of gas occupies 120 C.c. under 760 mM. pressure, how many C.c. will it occupy under 900 mM. pressure?

582.—If a mass of gas measuring one liter, under a pressure of 15 pounds to the sq. in., be subjected to a pressure of 30 pounds to the sq. in., what volume will it occupy?

583.—If a given mass of gas at 15°C., measures one liter under 760 mM. pressure, how much will it measure at 10°C. under 1,000 mM. pressure?

584.—One liter of oxygen at 0°C. and under 760 mM. pressure weighs 1.43 Gm. What is the weight of 2 liters of oxygen at 16°C. under 750 mM. pressure?

585.—One liter of hydrogen at 0°C. and under 760 mM. pressure weighs 0.08958 Gm. What is the weight of 5 liters of hydrogen at —20°C. under 800 mM. pressure?

586.—One liter of nitrogen at 0°C. under 760 mM. pressure weighs 1.25 Gm. What will be the volume of 5 Gm. of nitrogen at —10°C. under 758 mM. pressure?

587.—One liter of air at 0°C. under 760 mM. pressure weighs 1.2932 Gm. What is the volume of one pound of air at 10°C. under the pressure of three atmospheres?

588.—One liter of carbon dioxide at 0°C. under a pressure of one atmosphere weighs 1.9657 Gm. What is the volume of 10 kilograms of CO_2 at 8°C. under a pressure of four atmospheres?

589.—What pressure will be required to reduce ten liters of carbon dioxide at 15°C. to four liters at 2°C.?

590.—If one liter of carbon dioxide at 4°C. under a pressure of four atmospheres be warmed to 20°C., and the pressure at the same time reduced to 30 inches, what volume will the gas occupy?

PART XII.

THE ABSORPTION OF GASES BY LIQUIDS.

The extent to which gases dissolve in liquids depends upon the kind of gas, the temperature, and the pressure.

Each gas has its own specific *co-efficient of absorption*, by which is meant the volume of gas absorbed by one volume of the solvent, at a given temperature, under 760 mM. pressure?

The following are the co-efficients of absorption, at 0°C., under 760 mM. pressure, of the gases named, respectively:

Hydrogen	0:0193
Nitrogen	0.02035
Oxygen	0.04114
Nitrous Oxide	1.3052
Carbon Dioxide	1.7967
Hydrogen Sulphide	4.3706
Sulphur Dioxide	7.9789

The pressure being constant, the amount of gas dissolved will be less, the higher the temperature is.

The temperature being constant, the volume of gas dissolved increases directly as the pressure.

In computing the volume of any gas dissolved, when that gas is mixed with another gas, it must be remem-

bered that the pressure is in the same ratio as the proportion of that gas in the mixture. Thus, for instance, when one volume of water acts upon air at 0°C., under 760 mM. pressure, the nitrogen, which constitutes $\frac{79}{100}$ of the volume of the air, is subject to $\frac{79}{100}$ of 760, and the oxygen is subject to $\frac{21}{100}$ of 760 mM. pressure.

591.—If 100 C.c. of water at 10°C. dissolve 118 C.c. of carbon dioxide, how much carbon dioxide will be dissolved by a liter of water when shaken with air containing 0.05 per cent. of CO_2?

592.—The co-efficient of absorption of carbon dioxide being 1.7967, what volume of carbon dioxide will be dissolved by one liter of water at 10°C. under a pressure of two atmospheres?

593.—How much sulphur dioxide will be dissolved by two liters of water at 15°C., barometer at 30 inches?

594.—How much carbon dioxide will be dissolved by 20 gallons of water at 0°C., under the pressure of six atmospheres?

595.—What pressure is necessary to dissolve 300 cubic feet of carbon dioxide in 20 gallons of water at 15°C.?

596.—How many kilograms of carbon dioxide will be required to saturate 30 gallons of water at 0°C., under a pressure of 50 pounds to the square inch?

PART XIII.

SPECIFIC WEIGHT AND VOLUME.

SPECIFIC WEIGHT.

The specific weights of solids and liquids are expressed in water units; that is, the specific weight of water is ONE (1.000). The specific weight of any solid or liquid is therefore expressed by a number showing how many times the weight of a given volume of water is contained in the weight of the same volume of that solid or liquid.

The weight of a given volume of a solid or liquid being known, and the weight of the same volume of water being also known, we may find the specific weight of the solid or liquid by the following simple rule:—*Divide the weight of the solid or liquid by the weight of an equal volume of water; the quotient is the specific weight.*

But the weight of a solid and the weight of an equal volume of water (the factors from which the specific weight may be computed) can be found either directly or indirectly.

The respective weights of equal volumes of several different liquids may be found by weighing a solid body, first in air, and afterwards in each of those liquids in

turn, the apparent loss of weight sustained by the solid when weighed in a liquid being always the weight of the same volume of that liquid. If the solid be weighed first in air and then in water, the difference between the two weights is the weight of the same volume of water.

Ex.: -If a cubic inch of metal is weighed first in air and then in water, the difference between its weight in air and its weight in water will be nearly 252.5 grains, because 1 cubic inch of water weighs nearly 252.5 grains.

If a solid measuring 1 C.c. be weighed first in air and then in ether, the difference between its weight in air and its weight in ether will be the weight of 1 C.c. of ether.

We can find

THE SPECIFIC WEIGHTS OF SOLIDS:—

1. *By dividing the weight of the solid by the weight of the same volume of water.*

2. *By weighing the solid first in air and then in water, and dividing the weight of the solid in air by its apparent loss of weight in water.*

3. *By dividing the weight of the solid in air by its apparent loss of weight in any liquid of known specific weight, and multiplying the quotient by that specific weight.*

Explanation:—If a solid be weighed in a liquid having the specific weight 0.900, then the weight of the same volume of water must be $\frac{10}{9}$ of the weight of the other liquid.

4. *If a solid be dropped in water in a graduated cylinder, the increase of volume indicated by the gradua-*

tions on the cylinder will show the volume of the solid. If therefore the weight of the solid in air be known, all that remains to be done, is to find the weight of the same volume of water, after which the usual division follows. (See Rule I on page 73.)

5. *If the solid be lighter than water*, we may nevertheless find its apparent loss of weight in water, or in other words the weight of the same volume of water, by loading it down with a heavier solid so as to force it under water while weighing it, and then deducting the apparent loss of weight in water of the heavier solid, from the total loss of weight of both solids, which would leave as a remainder the loss of weight of the lighter solid, or the weight of its own volume of water.

6. *A solid immersed in a liquid of the same specific weight will neither sink nor float*, but may be made to rest at any point in the body of the liquid. Hence, the specific weight of some solids may be ascertained by placing them in liquids in which they are insoluble, and then increasing or diminishing the specific weight of the liquid as the case may require, until the solid floats about anywhere in the liquid, after which the specific weight of the liquid is taken.

We may find

THE SPECIFIC WEIGHT OF LIQUIDS:—

1. *By the aid of the pycnometer or specific gravity bottle.* The weight of the water which the pycnometer holds being already known, the weight of its contents of the other liquid is taken and divided by the weight of the water; the quotient being the specific weight sought.

2. *The weight of a given volume of any liquid ascertained directly or indirectly in any manner whatever, may be divided by the weight of the same volume of water.*

3. *A solid may be weighed first in water, and then in the liquid of which the specific weight is to be found*, and its apparent loss of weight in the latter liquid divided by its apparent loss of weight in water.

4. We may also *take the specific weight of any liquid by weighing in that liquid a solid of known mass and specific weight*, and finding its loss of weight in the liquid. Thus:—If we know that a certain solid weighs 7 ounces and has the specific weight 7, and we find that it loses $1\frac{1}{4}$ ounces in weight when weighed in a certain liquid, then we of course know that the specific weight of that liquid must be $1\frac{1}{4}$, since the same volume of water weighs 1 ounce.

5. *Knowing the respective weights of equal volumes of any two liquids, we can easily compute the specific weight of one, if we know the specific weight of the other*, for the knowledge of the specific weight of any liquid enables us to find the weight of the same volume of water.

6. *The weight of a liter of any liquid in kilograms, expresses* (very nearly) *its specific weight.*

The weight of a C.c. of any liquid expressed in Gm., also expresses (very nearly) its specific weight.

The weight of an Imperial fluid-ounce of any liquid expressed in Avoirdupois-ounces, also expresses (very nearly) its specific weight.

This is because the liter and the kilogram, the C.c. and the Gm., and the Imperial fluid-ounce and

the Avoirdupois-ounce are, respectively, commensurate units.

The specific weight of any liquid may accordingly be found by dividing its weight in kilograms by its volume expressed in liters, or by dividing its weight in Gm. by its volume in C.c., or by dividing its weight in Avoirdupois-ounces by its volume in Imperial fluid-ounces.

7. *The specific weight of any liquid may also be found from the weight of 6 pints of it expressed in Avoirdupois-ounces;* that weight is to be divided by 100, and the quotient will be the specific weight because 96 U. S. fluid-ounces of water weighs 100 Avoirdupois-ounces.

Law of Archimedes:—A body suspended in any fluid is buoyed up by that fluid with a force equal to the weight of its own volume of the fluid.

597.—A piece of metal weighs 7 ounces; the same volume of water weighs 1 ounce; what is the specific weight of the metal?

598.—A one-thousand grain pycnometer holds 720 grains of ether; what is the specific weight of the ether?

599.—A bottle holds 480 grains of water, but 576 grains of nitric acid; what is the specific weight of that nitric acid?

600.—If twenty Imperial fluid-ounces of a liquid weigh $1\frac{1}{4}$ Avoirdupois-pounds, what is the specific weight of that liquid?

601.—A fluid-ounce of alcohol at 22°C. weighs 373

grains, and a fluid-ounce of water at the same temperature weighs 455 grains; what is the specific weight of that alcohol referred to water at 22°C. as =1.000?

602.—A liter of diluted alcohol weighs 925 Gm.; what is the sp. w. of that alcohol?

603.—A liter of glycerin weighs 1,250 Gm.; what is its sp. w.?

604.—If a bottle hold one-half ounce of water, but will hold five drachms of a certain solution of sodium carbonate, what is the sp. w. of that solution?

605.—If one gallon of ether and one-half gallon of chloroform have the same weight, and two pints of chloroform weigh the same as three pints of water, what is the sp. w. of the ether?

606.—If a graduated cylinder contain 30 C.c. of water, and if a solid weighing 13 Gm. and dropped into the water raises the level of the water to 40 C.c., what is the sp. w. of the solid?

607.—The weight of 3 gallons of water is 400 Avoirdupois-ounces, and the weight of 1 gallon of alcohol is 109 Avoirdupois-ounces; what is the sp. w. of the alcohol?

608.—An Imperial-gallon of oil of peppermint weighs 9 Avoirdupois-pounds; what is its sp. w.?

609.—Six wine-pints of solution of zinc chloride weighs 155.5 Avoirdupois-ounces; what is its sp. w.?

610.—A cubic inch of a certain solid weighs 2,525 grains: what is its sp. w.?

611.—Ten C.c. of a certain solid weighs 13 Gm.; what is the sp. w. of that solid?

612.—A solid weighs 4 Gm. in air and 4.75 Gm. in water; what is its sp. w.?

613.—A certain solid weighs 150 grains; the same volume of water weighs 160 grains; what is the specific weight of the solid?

614.—A piece of metal of the bulk of 161.7 cubic inches weighs 347,624.55 grains in air, and 306,839.75 grains in water; what is the weight in grains of 231 cubic inches (one wine-gallon) of water?

615.—A crystal weighs 10 Gm. in air and 9 Gm. in oil of turpentine, the specific weight of which is 0.860: what is the specific weight of the crystal?

616.—One C.c. of a certain solid weighs 870 milligrams; what is its specific weight?

617.—A piece of cork weighs 0.732 Gm. in air; a piece of metal weighs 7.7 Gm. in air, but only 6.6 Gm. in water; cork and metal tied together and weighed in water are found to weigh 4.182 Gm.; what is the specific weight of the cork?

618.—A piece of lard is put in a vessel of water, and alcohol is added to the water gradually and mixed with it until the piece of lard, instead of floating on the surface, may be placed at will in any position in the body of the liquid. A 50 Gm. pycnometer is now filled with the liquid, and the contents of the bottle found to weigh 46.9 Gm. What is the specific weight of the lard?

619.—If a piece of metal weigh 9 ounces in air, 8 ounces in water, and 8.1 ounces in oil, what is the specific weight of that oil?

620.—A solid measuring 10 C.c. when weighed immersed in oil of turpentine, is found to displace 8.6 Gm. of the oil; what is the specific weight of the oil of turpentine?

621.—Glycerin has the specific weight 1.250; 3 volumes of glycerin has the same weight as 5 volumes of ether; what is the specific weight of the ether?

622.—50 C.c. of nitric acid weighs 71 Gm.; 50 C.c. of hydrochloric acid weighs 58 Gm.; the specific weight of the hydrochloric acid is 1.160; what is the specific weight of the nitric acid?

623.—A certain bottle holds 100 ounces of glycerin, the specific weight of which is 1.250; how many ounces will that bottle hold of water?

624.—How much will the same bottle hold of ether, having the specific weight 0.720?

625.—How much will it hold of chloroform of the specific weight 1.470?

626.—How much will it hold of syrup having the specific weight 1.330?

627.—How much will it hold of alcohol having the specific weight 0.820?

628.—A solid weighing 3 ounces, and having the sp. w. 8, loses $\frac{1}{2}$ oz. in weight when weighed in a certain liquid. What is the sp. w. of that liquid?

Specific Volume.

The term specific volume was suggested by the author of this book in 1883, to express the relative volume of any liquid, as compared with the volume of an equal weight of water. The specific volumes of substances are inversely as their specific weights. If the sp. w. exceeds 1, the sp. vol. is less than 1, and *vice versa.* The specific volume of any liquid may be found:—

1. *By dividing 1 by the specific weight.*

Thus, if the specific weight be expressed in the

form of a common fraction, the specific volume is obtained by turning the common fraction upside down.

Ex.: —If the specific weight is $\frac{1}{2}$, the specific volume is $\frac{2}{1}$; if the specific weight is $\frac{9}{10}$, the specific volume is $\frac{10}{9}$; if the specific weight is $\frac{3}{4}$, the specific volume is $\frac{4}{3}$, etc.

(As a matter of course, the specific weight of any liquid can be deduced in a similar manner from the specific volume.)

2. The specific volume of a liquid may also be found, by *dividing the volume of a given weight of any liquid by the volume of the same weight of water.*

3.—The specific volume *of any liquid* is also found *by dividing the weight of a given volume of water by the weight of an equal volume of the other liquid.*

629.—The sp. w. of water being 1, what is its sp. vol.?

630.—If the sp. w. of a certain liquid be 1.500, what is its sp.vol.?

631.—If the sp. w. of a certain liquid is 0.800, what is its sp.vol.?

632.—The sp. w. being 0.400, what is the sp.vol.?

633.—The sp. w. being 1.250, what is the sp.vol.?

634.—One kilogram of a liquid measures 750 C.c.; what is the sp.vol.?

635.—One hundred Avoirdupois-ounces of a liquid measures 6 pints; what is its sp.vol.?

636.—If 300 Gm. of a liquid measure 280 C.c., what is its sp.vol.?

637.—If four Imperial-pints of a liquid weigh 6 ℔, what is its sp.vol.?

638.—If 5 ℔ of a liquid measure 70 Imperial fluid-ounces, what is its sp. vol.?

639.—If one liter of a certain liquid weigh 1,200 Gm., what is its sp.vol.?

640.—If 300 C.c. of a liquid weigh 280 Gm., what is its sp.vol.?

641.—10 C.c. of a solution weighs 15 Gm.; what is the specific volume of the solution?

642.—10 C.c. of a liquid weighs 6.66 Gm.; what is the specific volume of that liquid?

643.—A certain solid weighed in water sustains an apparent loss of weight of 1 ounce; weighed in ether it sustains an apparent loss of $\frac{3}{4}$ of an ounce; what is the specific volume of the ether?

644.—One ounce of a certain solution measures 35 C.c., while an ounce of water measures 30 C.c.; what is the specific volume of the solution?

645.—A certain solid measures 10 C.c., and weighs 9 Gm.; what is its specific volume?

646.—A solid body displaces 1 ounce of water and 9 ounces of oil; what is the specific volume of the oil?

To Find the Weights of Given Volumes and the Volumes of Given Weights of Liquids.

1. To find the weight of any number of liters of any liquid, the specific weight of which is known:—*Multiply the liters by the specific weight; the answer is the weight expressed in kilograms.*

To find the weight in Gm. of any number of C.c.:—*Multiply by the specific weight.*

To find the weight in Avoirdupois-ounces of any number of Imperial fluid-ounces:—*Multiply by the specific weight.*

2. To find the weight of 6 pints of any liquid of which the specific weight is known:—*Multiply the specific weight by 100; the answer is the weight sought, expressed in Avoirdupois-ounces.*

3. We may also find the weight of any given volume of any liquid by *multiplying the weight of the same volume of water by the specific weight of the other liquid.*

We may also find the weight of any given volume of water from the weight of an equal volume of any other liquid, the specific weight of which is known, *by dividing the weight of that liquid by its specific weight.*

4. To find the volume of any number of kilograms of any liquid, the specific weight of which is known:—*Multiply the number of kilograms by the specific volume of the liquid: the answer expresses the volume in liters.*

5. The volume of any number of Gm. expressed in C.c. will be obtained by *multiplying the Gm. by the specific volume.*

6. The volume of any number of Avoirdupois-ounces will be found in Imperial fluid-ounces by *multiplying by the specific volume..*

7. The volume of 100 Avoirdupois-ounces of any liquid will be found expressed in U. S. fluid-ounces by *multiplying the specific volume by 96; or it will be found in pints by multiplying the svecific volume by 6.*

N. B.—A multiplication by the specific weight gives the same result as a division by the specific volume; and

a division by the specific weight gives the same result as a multiplication by the specific volume.

647.—What is the weight of 250 C.c. of a liquid having the sp. w. 1.100?

648.—What is the weight of one liter of a liquid of 0.900 sp. w.?

649.—What is the weight of one liter of a liquid having the sp. w. 1.320?

650.—What is the weight of 30 C.c. of a liquid having the sp. w. 0.720?

651.—What is the weight, in Avoirdupois-ounces, of an Imperial-pint of a liquid having the sp. w. 1.160?

652.—What is the weight, in Avoirdupois-ounces, of 100 Imperial fluid-ounces of a liquid having the sp. w. 0.960?

653.—What is the weight, in pounds, of an Imperial-gallon of a liquid having the sp.w. 1.300?

654.—What is the weight, in Avoirdupois-ounces, of 6 wine-pints of a liquid having the sp.w. 0.820?

655.—What is the weight, in Avoirdupois-ounces, of 3 Apothecaries'-pints of a liquid having the sp. w. 1.250?

656.—What is the weight, in Avoirdupois-ounces, of 16 U. S. fluid-ounces of a liquid having the sp.w. 1.260?

657.—If a cubic inch of water weigh 252.50 grains, what is the weight of 231 cubic inches of a liquid having the sp.w. 0.900?

658.—If one U. S. fluid-ounce of water weigh 0.95 Apothecaries'-ounce, what is the weight of one U. S. fluid-ounce of a liquid having the sp.w. 0.860?

659.—What will 3 kilograms of nitric acid measure if its sp.w. is 1.420?

660.—What is the volume of 640 Gm. of a liquid having the sp.vol. 0.800?

661.—What is the volume of 1 kilogram of a liquid having the sp.vol. 1.200?

662.—What is the volume of 800 Gm. of any liquid having the sp.vol. 0.900?

663.—What is the volume of a pound of olive oil, its sp. vol. being 1.091? Give the answer in Imperial fluid ounces.

664.—What is the volume of 100 Avoirdupois-ounces of olive oil? Give the answer in U. S. fluid ounces.

665.—What is the volume of 100 Avoirdupois-ounces of olive oil, expressed in pints?

666.—What is the volume of 5 ℔ of any liquid having the sp. vol. 1.111? Give the answer in pints.

667.—Castor-oil has the sp. vol. 1.042. What is the volume of 6 ℔, stated in U. S. fluid-ounces?

Miscellaneous Problems.

668.—A piece of metal weighs 6,445.380 grains when weighed in air; when weighed suspended in water its apparent weight is 5,585.996 grains; its bulk is 3.40 cubic inches; what is the specific weight of the metal? and what is the weight of a cubic inch of water?

669.—A piece of brass weighs 480 grains in air, 420 grains in water, and 400 grains in a solution of sugar; what is the volume of 500 Gm. of that solution?

670.—One liter of water at 4° C. weighs, *in vacuo*, one kilogram; does it weigh more or less than 1,000 Gm. when weighed in air?

671.—Which is the heavier, a kilogram weight of brass or a kilogram weight of platinum when both are weighed in a vacuum? in air?

672.—Which is really heavier, a pound of wood or a pound of lead?

673.—A solid measuring 0.1 cubic decimeter is weighed first *in vacuo*, then in air, and lastly in water; one cubic inch of air weighs 0.3 grains, and a cubic inch of water 252.50 grains.

Find:—

a) The difference between the weight of that solid *in vacuo* and its weight in air.

b) The difference between its weight in air and its weight in water.

674.—The weight of air and of water being assumed to be as stated in problem 652, what is the weight of a cubic inch of metal having the specific weight 10.000?

675.—A ten-dollar gold coin weighs 258 grains in air; assuming its specific weight to be 18.300, what is its apparent loss of weight when weighed suspended in water?

676.—The sp. w. of chloroform being 1.500, what is the weight of 900 C.c.?

677.—What is the weight of one liter of any liquid having the sp.w. 0.750?

678.—What is the volume of 370 Gm. of any liquid of 0.800 sp.w.?

679.—If an Imperial-gallon of sulphuric acid weigh 18.35 Avoirdupois-pounds, what is the volume of 1,000 Gm. of that acid expressed in C.c.?

680.—If an Imperial-pint of syrup weigh 26 Avoir-

dupois-ounces, what is the volume of 1 kilogram of that syrup?

681.—If the sp. w. of oil of vitriol be twice that of olive oil, and if one liter of olive oil weigh 917 Gm., what is the weight of 500 C.c. of oil of vitriol?

682.—If a solid weigh 75 ounces, and the same volume of water 10 ounces, what is the apparent weight of that solid when weighed suspended in water?

683.—If a bullet weigh 13 ounces in air and 12 ounces in water, what will it appear to weigh in a liquid having 1.400 sp. w.?

684.—If a pound of water measure 15$\frac{3}{8}$ fluid-ounces, and a pound of a certain solution 7$\frac{11}{16}$ fluid-ounces, what is the specific volume of that solution?

685.—What number of C.c. expresses the volume of 85.33 Gm. of a liquid having 1.01 sp.vol.?

686.—What number of Gm. expresses the weight of 13 476 liters of a liquid having 1.100 sp.w.?

687.—What is the weight of one liter solution of mercury nitrate, in kilograms, the sp. w. being 2.100?

688.—A solution of citrate of iron has the sp. w. 1.260; what is the weight of one wine pint, in Avoirdupois-ounces?

689.—The sp. w. of oil of turpentine being 0.860, what is the weight of 96 U. S. fluid-ounces of it, in Avoirdupois ounces?

690.—Which is the greater, the number expressing the sp. w. of acetic acid referring to water at 4° C. as unit, or the number expressing the sp. w. of the same acid referring to water at 15° C. as unit?

691.—A certain liquid at 39°.2 F. has the sp. w. 1.200 referring to water at 22° C. as unit; will the

number expressing its sp. w at 60°F., referring to water at 4° C. as unit, be greater or less than 1.200?

692.—The weight of one liter of water at 4°C. is 15,424 grains; but the weight of 500 C.c. of water at 22°C. is 7,696 grains. *a*) What is the sp. w. of water at 22°C. referring to water at 4° C. as a unit? and *b*) what is the sp. w. of water at 4°C. referring to water at 22° C. as = 1.000?

693.—An Imperial-gallon of water at 62°F., barometer at 30 inches, weighs 70,000 grains; *a*) does it weigh more or less at 15° C.? and *b*) does it weigh more or less when the atmospheric pressure is greater?

694.—A cubic inch of water at 22°C. weighs 252.5 grains. What is the weight of one wine-gallon of an alcohol having 0.860 sp. w., referring to water at 22°C. as = 1.000?

695.—What is the volume of 100 Apothecaries'-ounces of oil of 0.900 sp. w., if one cubic inch of water weighs 252.5 grains?

696. A liquid has the sp. w. 0.950; what is its sp. vol.?

697.—The sp. vol. of a liquid is 0.800; what is its sp. w?

698.—What is the specific volume corresponding to each of the following specific weights, respectively:—

a) 1.000?	*b*) 1.250?	*c*) 1.333?
d) 0.500?	*e*) 0.750?	*f*) 0.800?
g) 2.000?	*h*) 0.720?	*i*) 0.820?
k) 1.500?	*l*) 1.300?	*m*) 1.320?

699.—What is the volume of 1,000 Gm. of a liquid having the sp. vol. 1.200?

700.—What is the volume, in Imperial fluid-ounces, of 100 Avoirdupois-ounces of a liquid having the sp. vol. 0.800?

701.—What is the volume in U. S. fluid ounces of 25 Avoirdupois-ounces of a liquid having the sp. vol. 1.000?

702.—What number of C.c. expresses the volume of 85 Gm. of a liquid having the sp. w. 1.010?

703.—What number of C.c. expresses the volume of 85 Gm. of a liquid having the sp. vol. 1.010?

704.—What number of Gm. expresses the weight of 85 C.c. of a liquid having the sp. w. 1.010?

705.—What number of Gm. expresses the weight of 85 C.c. of a liquid having the sp. vol. 1.010?

706.—The total weight of a bottle filled with water is 30 ounces. The same bottle filled with olive oil weighs 28 ounces. What is the weight in ounces of the water the bottle is capable of holding? How many ounces of oil will it hold and what is the tare of the bottle?

707.—A bottle filled with water weighs 16 ounces; filled with chloroform having the specific weight 1.470, it weighs 19.877 ounces; filled with acid it weighs 17.32 ounces. What is the weight of the bottle? How much does it hold of water, chloroform, and acid, respectively, and what is the specific weight of the acid?

708.—A solid measuring 2 cubic inches weighs 6,000 grains in the air, but only 5,400 grains when weighed suspended in a certain liquid; what is the sp. w. of that liquid?

709.—A solid measuring 10 C.c. loses 1 Gm. in weight when weighed in a certain liquid; what is the sp. w. of that liquid?

710.—Alcohol has the sp. w. 0.820 at 15°6C. (60°F.).

The net weight of a barrel of alcohol at that temperature is found to be $300\frac{2}{3}$ pounds. How many gallons of alcohol does that barrel contain?

711. —*In what proportions should glycerin and water be mixed, to produce a mixture having the specific weight 1.100?

712. —*In what proportions must glycerin and alcohol be mixed, to produce a liquid of the density of water?

713. —*A certain mixture of water and syrup has the density 1.20; what are the proportions of syrup and water in the mixture?

714. —*What will be the specific weight of a mixture of equal parts by weight of alcohol, glycerin and water?

These examples, numbers 711 to 714, inclusive, may be solved by the rules given in Parts VII. and VIII. The contraction of volume occuring when water and alcohol are mixed is here to be ignored.

*—The specific weight of glycerin is 1.250; that of alcohol 0.820; that of syrup 1.330.

PART XIV.

CORRECTIONS FOR TEMPERATURE IN TAKING SPECIFIC WEIGHTS, ETC.

The specific weights of liquids vary according to the temperature. Corrections are therefore made for expansions or contractions at higher or lower temperatures when the observations have been taken at other temperatures, as may be required. These corrections may be made in accordance with observed "differences," or by the aid of observed "co-efficients of expansion."

Each liquid has its own *co efficient of expansion;* and in mixtures the co-efficient of expansion depends upon the proportions of the ingredients of the mixture.

Tables of differences and co-efficients of expansion are necessary to facilitate the work of making due corrections for differences of temperature.

When the *difference* for each degree above or below the standard temperature has been ascertained, that difference is simply multiplied by the number of degrees and added to or deducted from the observed specific weight, as the case may require.

When corrections are made by means of co efficients of expansion, the rules are as follows:—Designating the observed specific weight as a, the co-efficient of ex-

pansion as b, the number of degrees difference by the thermometric scale as c, and the corrected specific weight sought as x, we have:—

Rule I.—For correcting specific weight observed at a higher temperature to the specific weight at a given lower temperature:

$$\frac{a}{1-(b \times c)} = x.$$

Rule II.—For correcting specific weight observed at a lower temperature to the true specific weight at a given higher temperature:

$$\frac{a}{1+(b \times c)} = x.$$

715.—If the specific weight of a 10 per cent. alcohol at 15°C. is 0.9839, what will be the specific weight of the same alcohol at 20°C.?

716.—If the specific weight of a 20 per cent. alcohol at 20°C. be 0.970, what is the specific weight of the same alcohol at 12°C. and at 22°C.?

717.—What correction should be made in the specific weight of an alcohol of about 50 per cent. strength, the observation being taken at 25°C.?

718.—If the sp.w. of hydrochloric acid at 20°C. be 1.120, what is its sp.w. at 62°F.?

719.—If the observed sp. w. of nitric acid at 66°F. be 1.360, what is its sp.w. at 15°C.?

720.—If the observed sp. w. of sulphuric acid at 70°F. be 1.820, what is its sp. w. at 15°C.? and at 22°C.?

721.—If the observed specific weight of an alcohol at 20°C. be 0.8796, what is the percentage strength of that alcohol?

722.—If the specific weight of an alcohol, taken at 15°C., be found to be 0.8796, what is its percentage strength?

723.—If the observed specific weight of alcohol at 22°C. be 0.820, what correction should be made to get its specific weight at 15.6°C.? and at 62°F.?

724.—If the specific weight of a sample of alcohol at 62°F. be found to be 0.8227, what is the percentage strength?

725.—If the alcoholometer when placed in a jar of alcohol indicates 60 per cent. at a temperature of 55°F., what is the percentage strength of that alcohol at the standard temperature of the Revenue Service?

726.—If the sp. w. of alcohol taken at 15°C. be 0.870, what is the sp. w. at 22°C.? and at 20°C.?

727.—If the sp. w. of alcohol observed at 20°C. be 0.889, what would be its sp. w. at 15°C.?

728.—If the sp. w. of an ammonia solution at 21°C. be 0.900, *a*) what is its sp. w. at 15°C.? and *b*) at 14°C.?

729.—If alcohol at 22°C., when tested by the alcoholometer, appears to be 20 degrees above proof, what is its real strength in degrees proof by the standard of the Revenue Service?

730.—If the observed sp.w. of hydrochloric acid be 1.140 at 22°C., what is its sp.w. at 15°C? and at 20°C.?

731.—If the observed sp.w. of nitric acid be 1.400 at 18°C., what is its sp.w. at 22°C.? and at 15°C.?

732.—If the sp.w. of acetic acid at 22°C. be 1.070, what is its percentage strength, and what is its sp.w. at 15°C.? and at 62°F.?

733.—If the observed sp. w. of a sulphuric acid at 21°C. be 1.700, what is its sp. w. at 18°C.? and at 15°C.?

PART XV.

BEAUMÉ DEGREES REDUCED TO SPECIFIC WEIGHT, AND VICE VERSA.

LIQUIDS HEAVIER THAN WATER.

Rule I.—To convert Beaumé degrees into specific weight:—Divide 145 by 145 minus the number of degrees Beaumé:

$$\frac{145}{145 - B^\circ} = \text{Sp. w.}$$

Rule II.—To convert specific weight into the corresponding degree Beaumé:—Divide 145 by the specific weight; subtract the quotient from 145· the remainder is the corresponding degree Beaumé:

$$145 - \frac{145}{\text{Sp. w.}} = B^\circ$$

FOR LIQUIDS LIGHTER THAN WATER.

Rule III.—To convert any number of Beaumé degrees to specific weight:—Divide 140 by 130 plus the number of degrees Beaumé; the quotient is the specific weight:

$$\frac{140}{130 + B^\circ} = \text{Sp. w.}$$

RULE IV.—To convert specific weight into the corresponding number of degrees Beaumé:—Divide 140 by the specific weight, and from the quotient subtract 130; the remainder is the number of degrees Beaumé sought:

$$\frac{140}{\text{Sp. w.}} - 130 = \text{B}^\circ$$

734.—Reduce 20 degrees of Beaumé's acidometer to sp. w.?

735.—Reduce 16 degrees of Beaumé's spirit hydrometer to sp. w.

736.—Reduce 30 degrees of Beaumé's spirit hydrometer to sp. w.

737.—Reduce 40 degrees of Beaumé's acidometer to sp. w.

738.—Reduce sp. w. 1.42 to degrees Beaumé.

739.—Reduce 0.720 sp. w. to Beaumé degrees.

740.—Reduce 0.960 sp. w. to Beaumé degrees.

741.—Reduce 1.250 sp. w. to Beaumé degrees.

742.—Reduce 0.900 sp. w. to Beaumé degrees.

743.—Reduce 0.860 sp. w. to Beaumé degrees.

744.—Reduce 1.160 sp.w. to Beaumé degrees.

745.—Reduce 1.843 sp. w. to Beaumé degrees.

746.—Reduce 26° Beaumé's spirit hydrometer to sp. w.

747.—Reduce 18° Beaumé's spirit hydrometer to sp. w.

748.—Reduce 20° Beaumé's acidometer to sp. w.

749.—Reduce 43° Beaumé's acidometer to sp. w.

750.—Reduce 10° Beaumé's acidometer to sp. w.

PART XVI.

CHEMICAL SYMBOLS AND FORMULAS.

751.—Write the symbols of:—

Aluminum.	Potassium.	Chromium.
Arsenic.	Nitrogen.	Cobolt.
Iron.	Boron.	Platinum.
Bismuth.	Manganese.	Lithium.
Gold.	Magnesium.	Bromine.
Lead.	Carbon.	Tin.
Copper.	Sodium.	Antimony.
Calcium.	Mercury.	Silver.

752.—Write the names of the elements represented by the following symbols:—

Zn.	Pb.	H.	Si.
Sb.	Bi.	Hg.	As.
Mg.	Ag.	Ca.	I.
O.	S.	P.	B.
Sr.	Na.	Cl.	Br.
N.			

753.—Write the symbolic molecular formulas for:—

Hydrogen.	Chlorine.	Bromine.	Phosphorus.
Oyxgen.	Nitrogen.	Iodine.	Sulphur.
Ozone.	Mercury.	Cadmium.	

Hydrochloric Acid.
Hydrobromic Acid.
Hydrogen Iodide.
Potassium Chloride.
Sodium Bromide.
Silver Iodide.
Lithium Chloride.
Potassium Iodide.
Potassium Bromide.
Sodium Fluoride.
Sodium Chloride.
Silver Chloride.

Calcium Oxide.
Barium Sulphide.
Magnesium Oxide.
Calcium Sulphide.
Zinc Oxide.
Lead Oxide.
Cupric Oxide.
Mercuric Oxide.
Ferrous Sulphide.
Mercuric Sulphide.

Water.
Potassium Sulphide.
Argentic Sulphide.
Hydrogen Sulphide.
Sodium Oxide.
Mercurous Oxide.
Cuprous Oxide.

Strontium Chloride.
Calcium Iodide.
Magnesium Bromide.
Zinc Chloride.
Zinc Iodide.
Mercuric Chloride.
Mercurous Chloride.
Mercuric Iodide.
Mercurous Iodide.
Iodide of Lead.
Ferrous Chloride.
Ferrous Iodide.
Ferrous Bromide.

Phosphorus Trichloride.
Arsenous Chloride.
Bismuthous Chloride.
Nitrogen Trichloride.
Antimonous Chloride.
Hydrogen Nitride.
Hydrogen Phosphide.
Hydrogen Arsenide.

Bismuthous Oxide.
Chromic Oxide.

Antimonous Oxide.
Arsenous Oxide.
Ferric Oxide.
Ferric Sulphide.
Arsenous Sulphide.
Antimonous Sulphide.

Hydrogen Peroxide.
Sulphur Dioxide.
Sulphuric Anhydride.
Hypochlorous Oxide.
Perchloric Oxide.
Chloric Oxide.
Chlorous Oxide.
Nitrogen Monoxide.
Nitrogen Dioxide.
Nitrogen Tetroxide.
Nitrogen Trioxide.
Nitrogen Pentoxide.
Ammonia.
Phosphine.
Carbon Monoxide.
Carbon Dioxide.
Carbon Disulphide.
Cyanogen.
Stannous Chloride.

Potassium Hydrate.
Sodium Hydrate.
Lithium Hydrate.
Ammonium Hydrate.
Calcium Hydrate.
Ferrous Hydrate.
Ferric Hydrate.
Aluminum Hydrate.

Hydrochloric Acid.
Hydrobromic Acid.
Hydrocyanic Acid.
Hydrofluoric Acid.

Hypochlorous Acid.
Chloric Acid.
Nitrous Acid.
Nitric Acid.
Hypophosphorous Acid.

Sulphurous Acid.
Sulphuric Acid.
Thiosulphuric Acid.
Phosphorous Acid.
Arsenous Acid.
Carbonic Acid.
Pyroboric Acid.

Phosphoric Acid.
Arsenic Acid.

Boric Acid.

Pyrophosphoric Acid.

Potassium Nitrate.
Sodium Nitrate.
Ammonium Nitrate.
Silver Nitrate.
Bismuthyl Nitrate.
Barium Nitrate.

Mercuric Nitrate.
Cupric Nitrate.
Lead Nitrate.
Ferrous Nitrate.
Ferric Nitrate.

Potassium Chlorate.

Sodium Hypochlorite.
Calcium Hypochlorite.
Normal Potassium Sulphate.
Acid Potassium Sulphate.
Normal Sodium Sulphate.
Acid Sodium Sulphate.
Ammonium Sulphate.
Calcium Sulphate.
Magnesium Sulphate.

Zinc Sulphate.
Ferrous Sulphate.
Manganous Sulphate.
Cupric Sulphate.
Mercuric Sulphate.
Aluminum Sulphate.
Ferric Sulphate.
Potassa Alum.
Dried Alum.
Ammonia Alum.

Sodium Thiosulphate.
Potassium Thiosulphate.
Potassium Sulphite.
Sodium Sulphite.
Calcium Sulphite.
Magnesium Sulphite.
Potassium Phosphate.
Sodium Phosphate.
Ammonium Phosphate.
Calcium Phosphate.

Ferrous Phosphate.
Ferric Phosphate.
Sodium Pyrophosphate.
Ferric Pyrophosphate.
Potassium Hypophosphite.
Sodium Hypophosphite.
Calcium Hypophosphite.
Potassium Carbonate.
Potassium Acid Carbonate.

Sodium Carbonate.
Sodium Bicarbonate.
Lithium Carbonate.
Normal Ammonium Carbonate.
Official Ammonium Carbonate.
Bismuthyl Carbonate.
Calcium Carbonate.
Barium Carbonate.
Magnesium Carbonate.
Zinc Carbonate.
Lead Carbonate.
Borax.
Sodium Arsenate.
Potassium Arsenite.
Potassium Permanganate.

Formic Acid.
Acetic Acid.
Valeric Acid.
Lactic Acid.
Oleic Acid.
Salicylic Acid.
Benzoic Acid.
Oxalic Acid.
Tartaric Acid.
Citric Acid.

Potassium Acetate.
Sodium Acetate.
Ammonium Acetate.
Zinc Acetate.
Lead Acetate.
Cupric Acetate.
Ferric Acetate.

Sodium Valerate.
Ammonium Valerate.
Zinc Valerate.
Ferrous Lactate.
Potassium Oleate.
Sodium Oleate.
Zinc Oleate.
Mercuric Oleate.
Cupric Oleate.
Lead Oleate.
Ferric Oleate.
Normal Potassium Oxalate.
Acid Potassium Oxalate.
Ammonium Oxalate.
Cerium Oxalate.
Ferrous Oxalate.
Normal Potassium Tartrate.
Acid Potassium Tartrate.
Rochelle Salt.
Tartar Emetic.

Potassium Citrate.
Sodium Citrate.
Lithium Citrate.
Ammonium Citrate.
Magnesium Citrate.
Ferric Citrate.
Sodium Salicylate.
Zinc Salicylate.
Sodium Phenolsulphonate.
Zinc Phenolsulphonate.

Methane.
Ethane.
Propane.
Butane.
Pentane.
Hexane.

Methyl.
Ethyl.
Propyl.
Butyl.
Amyl.
Hexyl.

Methyl Oxide.
Ethyl Oxide.
Propyl Oxide.
Butyl Oxide.
Amyl Oxide.

Methyl Alcohol.
Ethyl Alcohol.
Propyl Alcohol.
Butyl Alcohol.
Amyl Alcohol.

Formic Aldehyde.
Common Aldehyde.
Propyl Aldehyde.
Butyl Aldehyde.
Amyl Aldehyde.

Acetone.

Cellulose.
Starch.
Cane Sugar.
Glucose.
Chloroform.
Iodoform.

Chloral.
Glycerin.
Carbolic Acid.
Morphine.
Quinine.
Strychnine.
Benzine.
Pyridine.
Aconitine.
Erythroxyline.
Atropine.
Aniline.
Piperine.

Collodion Cotton.
Santonin.
Salicin.
Tannic Acid.

PART XVII.

CHEMICAL EQUATIONS.

Write the reactions which occur in the combustion in oxygen or air of:—

754.—Carbon (complete combustion).

755.—Carbon (incomplete combustion).

756.—Hydrogen.

757.—Sulphur.

758.—Phosphorus.

759.—Magnesium.

760.—Zinc.

761.—CH_4 (complete combustion).

762.—CO.

763.—C_2H_5OH.

764.—Write the reaction occurring between iron and iodine in water.

Write the reactions representing the action of acids on metals, as follows:—

Hydrochloric Acid on

765.—Zinc.

766.—Iron.

767.—Aluminum.

768.—Tin.

769.—Nickel.

Cold dilute Nitric Acid on

770.—Zinc.

771.—Iron.

Warm dilute Nitric Acid on

772.—Zinc.

773.—Iron.

774.—Nickel.

775.—Lead.

776.—Copper.

777.—Silver.

778.—Mercury.

779.—Arsenic.

780.—Bismuth.

781.—Cobolt.

Strong Nitric Acid on

782.—Tin.

783.—Antimony.

Dilute Sulphuric Acid on

784.—Zinc.

785.—Iron.

786.—Nickel.

Hot Strong Sulphuric Acid on

787.—Copper.

788.—Mercury.

789.—Silver.

Write the reactions between *Hydrochloric Acid* and:—

790.—NH_3.

791.—CaO.

792.—BaO.

793.—SrO.

794.—MgO.

795.—ZnO.

796.—HgO.

797.—CuO.

798.—MnO_2.

799.—Fe_2O_3.

800.—KOH.

801.—$NaOH$.

802.—$LiOH$.

803.—NH_4OH.

804.—$Ca(OH)_2$.

805.—$Ba(OH)_2$.

806.—$Sr(OH)_2$.

807.—$Mg(OH)_2$.

808.—$Zn(OH)_2$.

809.—$Al_2(OH)_6$.

810.—$Fe_2(OH)_6$.

811.—$Ni_2(OH)_6$.

812.—$Cu(OH)_2$.

813.—K_2CO_3.

814.—Na_2CO_3.

815.—$KHCO_3$.

816.—$NaHCO_3$.
817.—Li_2CO_3.
818.—$(NH_4)_2CO_3$.
819.—NH_4HCO_3.
820.—$NH_4HCO_3.NH_4NH_2CO_2$.
821.—$CaCO_3$.
822.—$BaCO_3$.
823.—$SrCO_3$.
824.—$MgCO_3$.
825.—$4MgCO_3.Mg(OH)_2$.
826.—$2ZnCO_3.3Zn(OH)_2$.
827.—$ZnCO_3$.
828.—$2PbCO_3.Pb(OH)_2$.

Write the reactions between *Nitric Acid* and:—

829.—CaO.
830.—BaO.
831.—SrO.
832.—MgO.
833.—ZnO.
834.—Fe_2O_3.
835.—PbO.
836.—CuO.
837.—HgO.
838.—Bi_2O_3.
839.—AgO.
840.—KOH.
841.—$NaOH$.
842.—NH_4OH.
843.—NH_3.
844.—$Ca(OH)_2$.
845.—$Ba(OH)_2$.
846.—$Sr(OH)_2$.
847.—$Mg(OH)_2$.
848.—$Zn(OH)_2$.
849.—$Al_2(OH)_6$.
850.—$Fe_2(OH)_6$.
851.—$Cu(OH)_2$.
852.—$Pb(OH)_2$.
853.—K_2CO_3.
854.—$Na_2CO._3$
855.—$KHCO_3$.
856.—$NaHCO_3$.
857.—$(NH_4)_2CO_3$.
858.—NH_4HCO_3.
859.—$NH_4HCO_3.NH_4NH_2CO_2$.
860.—$CaCO_3$.
861.—$BaCO_3$.
862.—$SrCO_3$.
863.—$MgCO_3$.
864.—$4MgCO_3.Mg(OH)_2$.
865.—$ZnCO_3$.
866.—$2ZnCO_3.3Zn(OH)_2$.
867.—$2PbCO_3.Pb(OH)_2$.

Write the reactions between *Sulphuric Acid* and:—

868.—NH_3.
869.—MgO.
870.—ZnO.
871.—Fe_2O_3.
872.—MnO_2.
873.—Ni_2O_3.
874.—KOH.
875.—NaOH.
876.—NH_4OH.
877.—$Mg(OH)_2$.
878.—$Zn(OH)_2$.
879.—$Al_2(OH)_6$.
880.—$Fe_2(OH)_6$.
881.—$Cu(OH)_2$.
882.—K_2CO_3.
883.—Na_2CO_3.
884.—$KHCO_3$.
885.—$NaHCO_3$
886.—$(NH_4)_2CO_3$.
887.—NH_4HCO_3.
888.—$NH_4HCO_3.NH_4NH_2CO_2$.
889.—$MgCO_3$.
890.—$ZnCO_3$.
891.—$4MgCO_3.Mg(OH)_2$.
892.—$2ZnCO_3.3Zn(OH)_2$.

Write the reactions between *Hydrobromic Acid* and:—

893.—Iron.
894.—Zinc.
895.—NH_3.
896.—CaO.
897.—MgO.
898.—ZnO.
899.—KOH.
900.—NaOH.
901.—NH_4OH.
902.—LiOH.
903.—$Ca(OH)_2$.
904.—K_2CO_3.
905.—$KHCO_3$.
906.—Na_2CO_3.
907.—Li_2CO_3.
908.—$CaCO_3$.

Write the reactions of *Hydrocyanic Acid* with:—

909.—ZnO.
910.—HgO.
911.—KOH.
912.—LiOH.
913.—K_2CO_3.
914.—$KHCO_3$.

Write the reactions of *Phosphoric Acid* with:—

915.—Iron.
916.—NH_3.
917.—KOH.
918.—NaOH.
919.—K_2CO_3.
920.—Na_2CO_3.
921.—$CaCO_3$.

Write the reactions of *Acetic Acid* with:—

922.—NH_3.
923.—CaO.
924.—BaO.
925.—MgO.
926.—ZnO.
927.—PbO.
928.—HgO.
929.—CuO.
930.—AgO.
931.—KOH.
932.—NaOH.
933.—LiOH.
934.—NH_4OH.
935.—$Ca(OH)_2$.
936.—Iron.
937.—$Fe_2(OH)_6$.
938.—$Al_2(OH)_6$.
939.—K_2CO_3.
940.—$KHCO_3$.
941.—Na_2CO_3.
942.—$NaHCO_3$.
943.—NH_4HCO_3.
944.—$NH_4HCO_3.NH_4NH_2CO_2$.
945.—$MgCO_3$.
946.—$4MgCO_3.Mg(OH)_2$.
947.—$2ZnCO_3.3Zn(OH)_2$.
948.—$2PbCO_3.Pb(OH)_2$.

Write the reactions of *Oxalic Acid* with:—

949.—NH_3.
950.—KOH.
951.—NaOH.
952.—NH_4OH.
953.—K_2CO_3.
954.—$KHCO_3$.
955.—Na_2CO_3.
956.—$NaHCO_3$.
957.—NH_4HCO_3.
958.—$NH_4HCO_3.NH_4NH_2CO_2$.

Write the reactions of *Citric Acid* with:—

959.—NH_3.
960.—MgO.
961.—KOH.
962.—$NaOH$.
963.—$LiOH$.
964.—NH_4OH.
965.—$Mg(OH)_2$.
966.—$Fe_2(OH)_6$.
967.—K_2CO_3.
968.—$KHCO_3$.
969.—Na_2CO_3.
970.—$NaHCO_3$.
971.—Li_2CO_3.
972.—$(NH_4)_2CO_3$.
973.—NH_4HCO_3.
974.—$NH_4HCO_3.NH_4NH_2CO_2$.
975.—$MgCO_3$.
976.—$4MgCO_3.Mg(OH)_2$.

Write the reactions of *Tartaric Acid* with:—

977.—NH_3.
978.—MgO.
979.—KOH.
980.—$NaOH$.
981.—$LiOH$.
982.—NH_4OH.
983.—$Mg(OH)_2$.
984.—$Fe_2(OH)_6$
985.—K_2CO_3
986.—$KHCO_3$.
987.—Na_2CO_3.
988.—$NaHCO_3$.
989.—$NH_4HCO_3.NH_4NH_2CO_2$.
990.—$MgCO_3$
991.—$4MgCO_3$. $Mg(OH)_2$

Write the reactions of *Hydrochloric Acid* with:—

992.—KBr.
993.—$FeBr_2$.
994.—KI.
995.—FeI_2.
996.—CaI_2.
997.—ZnI_2.
998.—KCN.
999.—$AgCN$.
1000.—$Hg(CN)_2$.
1001.—K_2S.
1002.—CaS.
1003.—BaS.
1004.—FeS.
1005.—ZnS.

1006.—$KClO_3$.
1007.—$NaOCl$.
1008.—$Ca(OCl)_2$.
1009.—K_2SO_3.
1010.—Na_2SO_3.
1011.—$CaSO_3$.
1012.—$MgSO_3$.
1013.—$Na_2S_2O_3$.
1014.—NaH_2PO_2.
1015.—$CaH_4(PO_2)_2$.
1016.—$Na_2B_4O_7$.
1017.—$KC_2H_3O_2$.
1018.—$NaC_2H_3O_2$.
1019.—$NH_4C_2H_3O_2$.
1020.—$Zn(C_2H_3O_2)_2$.
1021.—$Pb(C_2H_3O_2)_2$.
1022.—$K_2C_4H_4O_6$.

Write the reactions of *Nitric Acid* with:—

1023.—Phosphorous.
1024.—HCl.
1025.—KBr.
1026.—KI.
1027.—CaI_2.
1028.—ZnI_2.
1029.—KCN.
1030.—K_2S.
1031.—CaS.
1032.—BaS.
1033.—FeS.
1034.—ZnS.
1035.—$KClO_3$.
1036.—$NaOCl$.
1037.—$Ca(OCl)_2$.
1038.—K_2SO_3.
1039.—Na_2SO_3.
1040.—$CaSO_3$.
1041.—$MgSO_3$.
1042.—$Na_2S_2O_3$.
1043.—NaH_2PO_2.
1044.—$CaH_4(PO_2)_2$.
1045.—$KC_2H_3O_2$.
1046.—$NaC_2H_3O_2$.
1047.—$NH_4C_2H_3O_2$.
1048.—$Zn(C_2H_3O_2)_2$.
1049.—$Pb(C_2H_3O_2)_2$.

Write the reactions of *Sulphuric Acid* with:—

1050.—KCl.
1051.—$NaCl$.
1052.—NH_4Cl.
1053.—KBr.
1054.—KI.
1055.—KCy.
1056.—K_2S.
1057.—FeS.

1058.—ZnS.
1059.—KNO_3.
1060.—$NaNO_3$.
1061.—$KClO_3$.
1062.—KOCl.
1063.—NaOCl.
1064.—$Ca(OCl)_2$.
1065.—K_2SO_3.
1066.—Na_2SO_3.
1067.—$CaSO_3$.
1068.—$MgSO_3$.
1069.—$Na_2S_2O_3$.
1070.—$Ca_3(PO_4)_2$.
1071.—NaH_2PO_2.
1072.—$CaH_4(PO_2)_2$.
1073.—$Na_2B_4O_7$.
1074.—$KC_2H_3O_2$.
1075.—$Na_2C_2H_3O_2$.
1076.—$NH_4C_2H_3O_2$.
1077.—$Zn(C_2H_3O_2)_2$.
1078.—$Fe(C_2H_3O_2)_2$.
1079.—$Pb(C_2H_3O_2)_2$.
1080.—$K_2C_2O_4$.
1081.—KHC_2O_4.
1082.—CaC_2O_4.
1083.—$K_3C_6H_5O_7$.
1084.—$Na_3C_6H_5O_7$.
1085.—$Mg_3(C_6H_5O_7)_2$.
1086.—$Ca_3(C_6H_5O_7)_2$.
1087.—$K_2C_4H_4O_6$.
1088.—$CaC_4H_4O_6$.

Write the reactions occurring when the following-named compounds are decomposed by high heat:—

1089.—$CaCO_3$.
1090.—$Ca(OH)_2$.
1091.—$Fe_2(OH)_6$.
1092.—$MgCO_3$.
1093.—$4MgCO_3.Mg(OH)_2$.
1094.—$2ZnCO_3.3Zn(OH)_2$.
1095.—FeC_2O_4.
1096.—$K_2C_4H_4O_6$.
1097.—$FeSO_4$.
1098.—KOCl.
1099.—$Cu(NO_3)_2$.
1100.—Sb_2S_3.
1101.—$Hg(NO_3)_2$.

Write the reactions between *Water* and:—

1102.—K_2.
1103.—Na_2.
1104.—Ca_2.
1105.—C at white heat.
1106.—CaO.
1107.—BaO.

1108.—$HgNO_3$.

1109.—$Bi(NO_3)_3$.

1110.—$SbCl_3$.

1111.—$HgSO_4$.

1112.—As_2O_3.

Write the reactions between *KOH* and:—

1113.—Zn_2.

1114.—NH_4Cl.

1115.—$(NH_4)_2SO_4$.

1116.—$CaCl_2$.

1117.—$MgSO_4$.

1118.—$MgCl_2$.

1119.—$ZnSO_4$.

1120.—$ZnCl_2$.

1121.—$CdSO_4$.

1122.—$Pb(C_2H_3O_2)_2$.

1123.—$Pb(NO_3)_2$.

1124.—$CuSO_4$.

1125.—Hg_2Cl_2.

1126.—$Hg_2(NO_3)_2$.

1127.—$HgCl_2$.

1128.—$Hg(NO_3)_2$.

1129.—$SnCl_2$.

1130.—$MnSO_4$.

1131.—$FeCl_2$.

1132.—FeI_2.

1133.—$FeBr_2$.

1134.—$FeSO_4$.

1135.—Fe_2Cl_6.

1136.—$Fe_2(SO_4)_3$.

1137.—$Fe_2(NO_3)_6$.

1138.—$FeNO_3$.

1139.—$Fe_2(C_2H_3O_2)_6$.

1140.—$CoCl_2$.

1141.—$NiCl_2$.

1142.—$SbCl_3$.

1143.—$SnCl_4$.

1144.—$Al_2(SO_4)_3$. K_2SO_4.

1145.—Sb_2S_3.

1146.—As_2O_3.

Write the reactions between NH_3 and:—

1147.—$ZnSO_4$.

1148.—$ZnCl_2$.

1149.—$Pb(C_2H_3O_2)_2$.

1150.—$Pb(NO_3)_2$.

1151.—$CuSO_4$.

1152.—$HgCl_2$.

1153.—$FeCl_2$.

1154.—$FeSO_4$.

1155.—Fe_2Cl_6.

1156.—$Fe_2(SO_4)_3$.

Write the reactions between *Na_2CO_3* and:—

1157.—$CaCl_2$.
1158.—$BaCl_2$.
1159.—$MgCl_2$.
1160.—$MgSO_4$.
1161.—$ZnCl_2$.
1162.—$ZnSO_4$.
1163.—$FeSO_4$.
1164.—$Fe(SO_4)_3$.
1165.—$FeCl_2$.
1166.—Fe_2Cl_6.
1167.—$Pb(C_2H_3O_2)_2$.
1168.—$Pb(NO_3)_2$.
1169.—$CuSO_4$.
1170.—$AgNO_3$.

Write the reactions of *Hydrogen Sulvhide* with:—

1171.—H_3AsO_4.
1172.—$CuSO_4$.
1173.—$CdSO_4$.
1174.—$Pb(NO_3)_2$.
1175.—$Pb(C_2H_3O_2)_2$.
1176.—$HgCl_2$.
1177.—$Cu(NO_3)_2$.

Write the reactions of *Ammonium Sulphide* with:—

1178.—$ZnSO_4$.
1179.—$ZnCl_2$.
1180.—$MnSO_4$.
1181.—$FeSO_4$.
1182.—$FeCl_2$.
1183.—$Fe_2(SO_4)_3$.
1184.—Fe_2Cl_6.
1185.—$Al_2(SO_4)_3$. K_2SO_4.
1186.—$CrCl_2$.

Write the reactions of *KCl* with:—

1187.—$AgNO_3$.
1188.—$Pb(NO_3)_2$.
1189.—$Pb(C_2H_3O_2)_2$.
1190.—$Hg_2(NO_3)_2$

Write the reactions of *KI* with:—

1191.—Fe_2Cl_6.
1192.—$AgNO_3$.
1193.—$Pb(NO_3)_2$.
1194.—$Pb(C_2H_3O_2)_2$.
1195.—$Hg_2(NO_3)_2$.
1196.—$Hg(NO_3)_2$.
1197.—$HgCl_2$.
1198.—$BiONO_3$.

Write the reactions of *Sodium Phosphate* with:—

1199.—$AgNO_3$.
1200.—$CaCl_2$.
1201.—$BaCl_2$.
1202.—$MgSO_4$.
1203.—$ZnSO_4$.
1204.—$ZnCl_2$.
1205.—$Zn(C_2H_3O_2)_2$.
1206.—$CdSO_4$.
1207.—$Pb(NO_3)_2$.
1208.—$Pb(C_2H_3O_2)_2$.
1209.—$CuSO_4$.
1210.—$HgCl_2$.
1211.—$Ba(NO_3)_2$.
1212.—$Hg(NO_3)_2$.
1213.—$MnSO_4$.
1214.—$FeCl_2$.
1215.—$FeSO_4$.
1216.—$Fe_2(SO_4)_3$.
1217.—Fe_9Cl_6.

Write the reactions of *Sodium Sulphate* with:—

1218.—$CaCl_2$.
1219.—$Ca(NO_3)_2$.
1220.—$BaCl_2$.
1221.—$Ba(NO_3)_2$.
1222.—$SrCl_2$.
1223.—$Pb(NO_3)_2$.
1224.—$Pb(C_2H_3O_2)$.
1225.—$HgCl_2$.

Write the reactions of *Sodium Hypophosphite* with:—

1226.—$FeSO_4$.
1227.—$FeCl_2$.
1228.—Fe_2Cl_6.
1229.—$Fe_2(SO_4)_3$.

Write the reactions of *Ammonium Oxalate* with:—

1230.—$CaCl_2$.
1231.—$BaCl_2$.
1232.—$SrCl_2$.
1233.—$FeSO_4$.
1234.—$Fe_2(SO_4)_3$.
1235.—$FeCl_2$.
1236.—Fe_2Cl_6.

Write the reactions between:—

1237.—Oxalic acid and potassium acetate.

1238.—Oxalic acid and ferrous sulphate.

1239.—Tartaric acid and potassium acetate.

1240.—Tartaric acid and potassium tartrate.

1241.—Tartaric acid and Rochelle salt.

1242.—Citric acid and potassium acetate.

1243.—Tartaric acid and potassium bromide.

1244.—Tartaric acid and potassium cyanide.

1245.—Tartaric acid and potassium iodide.

1246.—Citric acid and bismuth subnitrate.

1247.—Potassium bichromate and sulphuric acid.

1248.—Calcium hydrate and mercuric chloride.

1249.—Calomel and calcium hydrate.

1250.—Bismuthyl nitrate and sodium hydrate.

1251.—Oxychloride of antimony and sodium carbonate.

1252.—Potassium carbonate and calcium hydrate.

1253.—Sodium carbonate and calcium hydrate.

1254.—Ammonium chloride and calcium hydrate.

1255.—Ammonium chloride and potassium carbonate.

1256.—Sodium carbonate and alum.

1257.—Mercuric sulphate and mercury, when triturated together.

1258.—Mercury and iodine, triturated together.

1259.—Mercurous sulphate and sodium chloride, when a mixture of them is heated.

1260.—Mercuric sulphate and sodium chloride, mixed and heated together.

1261.—Mercuric chloride, in solution, poured into a solution of ammonium hydrate.

1262.—Solution of ammonium hydrate poured into solution of mercuric chloride.

1263.—Gold dissolved in "Aqua Regia."

1264.—Bismuthyl nitrate and sodium chloride.

1265.—Antimonous sulphide and hydrochloric acid, heated together.

1266.—Bromine and potassium hydrate.

1267.—Iodine and potassium hydrate.

1268.—Ferrous bromide and potassium carbonate.

1269.—Ferrous iodide and potassium carbonate.

1270.—Ferrous bromide and ammonia.

1271.—Calcium hydrate and ammonium bromide.

1272.—Zinc sulphate and potassium bromide.

1273.—Hydrogen sulphide and iodine.

1274.—Iodine and sulphur, heated together.

1275.—Potassium iodide and ammonium sulphate.

1276.—Calcium hydrate and ferrous iodide.

1277.—Manganous sulphate and potassium iodide.

1278.—Arsenic and iodine, heated together.

1279.—Potassium ferrocyanide and sulphuric acid, heated together.

1280.—Potassium ferrocyanide and potassium carbonate, fused together.

1281.—Zinc acetate and hydrocyanic acid.

1282.—Ferric chloride and ferrocyanide of potassium.

1283.—Hydrocyanic acid and mercuric oxide.

1284.—Silver nitrate and hydrocyanic acid.

1285.—Sulphur and potassium carbonate, heated strongly together.

1286.—Potassium sulphate and carbon, heated strongly together.

1287.—Lime and sulphur, strongly heated together.

1288.—Calcium hydrate and sulphur, boiled together in water.

1289.—Mercury and sulphur, triturated with each other.

1290.—Antimonous sulphide, boiled with solution of sodium hydrate.

1291.—Sodium antimonite and sulphuric acid.

1292.—Sodium sulphantimonite and sulphuric acid.

1293.—Schlippe's salt and sulphuric acid.

1294.—Antimonous sulphide, sulphur, and sodium hydrate, boiled together in water.

1295.—Normal bismuth nitrate and sodium carbonate.

1296.—Normal bismuth nitrate and ammonium hydrate.

1297.—Chlorine and potassium hydrate in water.

1298.—Calcium chlorate and potassium chloride.

1299.—Calcium hydrate, potassium chloride and chlorine, in water.

1300.—Sodium carbonate and calcium hypochlorite.

1301.—Copper filings, sulphuric acid and nitric acid.

1302.—Sodium sulphite boiled with sulphur.

1303.—Metaphosphoric acid boiled with water.

1304.—Sulphuric acid and bone ash.

1305.—Sodium carbonate and acid phosphate of calcium.

1306.—Calcium phosphate and hydrochloric acid.

1307.—Ammonium sulphate and chalk, heated together.

1308.—Ammonium chloride and chalk, heated together.

1309.—Official ammonium carbonate and ammonium hydrate.

1310.—Arsenous oxide, sodium nitrate, and sodium carbonate, heated together.

1311.—Sodium arsenate and ferrous sulphate.

1312.—Potassium acid carbonate and arsenous oxide.

1313.—Lead acetate and potassium carbonate.

1314.—Lead acetate and sodium carbonate.

1315.—Potassium acetate and ferric sulphate.

1316.—Lead oxide and lead acetate in water.

1317.—Copper sulphate and lead acetate.

1318.—Copper sulphate and lead nitrate.

1319.—Zinc sulphate and sodium valerate.

1320.—Lactic acid and zinc carbonate.

1321.—Olive oil and potassium hydrate.

1322.—Castile soap and zinc acetate.

1323.—Castile soap and alum.

1324.—Castile soap and ferric sulphate.

1325.—Sodium oleate and lead acetate.

1326.—Sodium oleate and copper sulphate.

1327.—Mercuric nitrate and potassium oleate.

1328.—Mercuric oxide and oleic acid.

1329.—Silver nitrate and castile soap.

1330.—Cream of tartar and chalk, boiled together in water.

1331.—Calcium tartrate and sulphuric acid.

1332.—Cream of tartar and potassium carbonate.

1333.—Cream of tartar and sodium carbonate.

1334.—Cream of tartar and ferric hydrate.

1335.—Cream of tartar and antimonous oxide.

1336.—Cream of tartar and borax.

1337.—Calcium citrate and sulphuric acid.

1338.—Subnitrate of bismuth boiled with citric acid.

1339.—Sodium citrate with bismuth nitrate.

1340.—Phenol and sulphuric acid, heated together by water-bath heat.

1341.—Phenolsulphonate acid and barium carbonate.

1342.—Barium phenolsulphonate and sodium carbonate.

1343.—Barium phenolsulphonate and zinc sulphate.

1344.—Phenol and nitric acid.

1345.—Salicylic acid and sodium bicarbonate.

1346.—Magnesium bromide and chlorine.

1347.—Carbon and ferric oxide, heated strongly together.

1348.—Phosphorus and calcium hydrate, heated together in water.

1349.—Phosphorus and potassium hydrate, heated together in water.

1350.—Carbonic acid and barium peroxide.

1351.—Salt, sulphuric acid and black oxide of manganese.

1352.—Phosphorus pentoxide and water.

1353.—Sulphuric anhydride and water.

1354.—Sulphur dioxide and nitrogen tetroxide with water.

1355.—Mercuric oxide and chlorine.

1356.—Ammonium carbamate and water.

1357.—Sodium acid tartrate and potassium chlorate.

1358.—Nitric acid and arsenous oxide.

1359.—Nitric acid and bismuthyl carbonate.

1360.—Calcium hypophosphite and sodium carbonate.

1361.—Ferric hydrate and arsenous oxide.

1362.—Sodium sulphate, chalk and carbon, heated strongly together.

1363.—Calcium sulphite and sodium sulphate.

1364.—Calcium chloride and alum.

1365.—Potassium manganate and chlorine.

1366.—Sodium thiosulphate and iodine.

1367.—Write the reaction representing the changing of ferrous chloride to ferric chloride by means of hydrogen chloride and nitric acid.

1368.—Write the reaction which takes place when ferrous sulphate is changed to normal ferric sulphate with the aid of sulphuric and nitric acids.

Write the correct chemical titles of the compounds represented by the following molecular formulas:—

1369.—HCH_2H.

1370.—$H(CH_2)_2H$.

1371.—$H(CH_2)_3H$.

1372.—$H(CH_2)_4H$.

1373.—$H(CH_2)_5H$.

1374.—$H(CH_2)_6H$.

1375.—$(CH_3)_2O$.

1376.—$(C_2H_5)_2O$.

1377.—$(C_3H_7)_2O$.

1378.—$(C_4H_9)_2O$.

1379.—$(C_5H_{11})_2O$.

1380.—$(C_6H_{13})_2O$.

1381.—HCH_2OH

1382.—$H(CH_2)_2OH$.

1383.—$H(CH_2)_3OH$.

1384.—$H(CH_2)_4OH$.

1385.—$H(CH_2)_5OH$.

1386.—$H(CH_2)_6OH$.

1387.—$H.CO.H$.

1388.—$H.CH_2.CO.H$.

1389.—$H.(CH_2)_2.CO.H$.

1390.—$H.(CH_2)_3.CO.H$.

1391.—$H.(CH_2)_4.CO.H$.

1392.—$H.CO.CH_2.H$

1393.—$H.CH_2.CO.CH_2.H$.

1394.—$H.(CH_2)_2.CO.CH_2.H$.

1395.—$H.(CH_2)_3.CO.CH_2.H$.

1396.—$H.CO.OH$.

1397.—$H.CH_2.CO.OH$.

1398.—$H.(CH_2)_2.CO.OH$.

1399.—$H.(CH_2)_3.CO.OH$.

1400.—$H.(CH_2)_4.CO.OH$.

1401.—CH_3Cl.
1402.—CH_2Cl_2.
1403.—$CHCl_3$.
1404.—$NH_2.CH_3$.
1405.—$NH.(CH_3)_2$.
1406.—$N(CH_3)_3$.
1407.—CH_3I.
1408.—C_2H_5I.
1409.—CH_3Br.
1410.—C_2H_5Br.
1411.—CHI_3.
1412.—$CHBr_3$.
1413.—$C_2H_5HSO_4$.
1414.—$C_2H_5C_2H_3O_2$.
1415.—$C_2H_5NO_2$.
1416.—$C_5H_{11}C_2H_3O_2$.
1417.—$HCHO_2$.
1418.—$HC_2H_3O_2$.
1419.—$HC_3H_5O_2$.
1420.—$HC_4H_7O_2$.
1421.—$HC_5H_9O_2$.
1422.—$HC_3H_5O_3$.
1423.—$H_2C_4H_4O_4$.
1424.—$H_2C_4H_4O_5$.
1425.—$H_2C_4H_4O_6$.
1426.—$HC_7H_5O_2$.
1427.—$HC_7H_5O_3$.
1428.—$HC_7H_5O_5$.
1429.—$H_3C_4H_3O_5$.
1430.—$HC_9H_7O_2$.
1431.—HC_7HO_7.
1432.—C_6H_6.
1433.—C_3H_8.
1434.—$C_{10}H_8$.
1435.—$C_{10}H_{16}$.
1436.—$C_{12}H_{16}$.
1437.—$C_{14}H_{10}$.
1438.—$C_6H_{10}O_5$.
1439.—$C_6H_{22}O_6$.
1440.—$C_{12}H_{22}O_{11}$.
1441.—$C_6H_4O_2$.
1442.—$C_6H_{12}O_3$.
1443.—C_8H_8O.
1444.—$C_7H_8O_2$.
1445.—$C_{10}H_{18}O$.
1446.—$C_{10}H_{16}O$.
1447.—$C_{14}H_8O_2$.
1448.—$C_{14}H_6O_4$.
1449.—$C_{15}H_{18}O_3$.
1450.—$C_{18}H_{18}O_7$.
1451.—$C_6H_4(OH)_2$.
1452.—$C_{10}H_7OH$.
1453.—$C_3H_5(OH)_3$.
1454.—$C_3H_5(NO_3)_3$.
1455.—$CH_2(OCH_3)_2$.
1456.—$CH_3.CO.Cl$.
1457.—$C_6H_5.CH_3$.
1458.—$C_6H_5.C_2H_5$.
1459.—$C_6H_5.NH_2$.
1460.—$C_6H_5.OH$.
1461.—$C_6H_5.COH$.
1462.—$C_6H_5.C_7H_5O_3$.
1463.—C_6H_5N.
1464.—C_6H_7N.

1465.—$C_5H_5N_5O$.
1466.—C_5H_5N.
1467.—C_9H_7N.
1468.—CN_2H_4O.
1469.—$C_2H_3ONH_2$.
1470.—$C_5H_4N_4O_2$.
1471.—$C_2H_3NH_2CO_2$.
1472.—$C_{10}H_{13}NO_2$.
1473.—$C_7H_{16}O_4S_2$.
1474.—C_8H_8NO.
1475.—$C_8H_{10}N_4O_2$.
1476.—$C_8H_{15}N$.
1477.—$C_{10}H_{14}N_2$.
1478.—$C_3H_4NCl_3O_2$.
1479.—$C_8H_{10}N_2O$.
1480.—$C_9H_{11}NO_2$.
1481.—$C_{11}H_{12}N_2O$.
1482.—$C_{15}H_{23}NO_3$.
1483.—$C_{17}H_{21}NO_4$.
1484.—$C_{17}H_{19}NO_3$.
1485.—$C_{17}H_{17}NO_2$.
1486.—$C_{17}H_{23}NO_3$.
1487.—$C_{18}H_{21}NO_3$.
1488.—$C_{20}H_{24}N_2O_2$.
1489.—$C_{20}H_{24}N_2O$.
1490.—$C_{20}H_{27}NO_{11}$.
1491.—$C_{21}H_{19}NO_5$.
1492.—$C_{21}H_{22}N_2O_2$.
1493.—$C_{33}H_{43}NO_{12}$.
1494.—$C_{32}H_{32}N_2O_8$.
1495.—C_4NHI_4.
1496.—$C_{17}H_{18}O_2I_2$.

Write the reactions showing:—

1497.—The formation of alcohol by the splitting up of glucose.

1498.—Conversion of starch into dextrin and glucose by the action of the salivary ferment.

1499.—The splitting up of sucrose into dextrose and levulose.

1500.—The formation of glucose from maltose and starch.

1501.—The action of nitric acid on cotton.

1502.—The action of sodium on alcohol.

1503.—The oxidation of alcohol to acetic acid.

1504.—The formation of aldehyde from alcohol by the action of chlorine.

1505.—The formation of chloral from aldehyde by the action of chlorine.

1506.—The action of KOH on chloral.

1507.—The formation of methane by heating sodium acetate with sodium hydrate.

1508.—The formation of ethane by the action of sodium on monochlormethane.

1509.—The formation of formic acid by the action of carbon monoxide on KOH.

1510.—The formation of ammonium carbamate by the action of dry CO_2 on dry NH_3.

1511.—The formation of benzine by the action of lime on benzoic acid.

1512.—How iodoform results from the action of iodine and $KHCO_3$ on alcohol.

1513.—How ethylsulphuric acid results from the action of sulphuric acid on alcohol.

1514.—How ether is formed from ethylsulphuric acid and alcohol.

1515.—The reactions between sodium acetate, sulphuric acid, and alcohol.

1516.—The action of nitric acid on alcohol.

1517.—The action of nitrous acid on alcohol.

1518.—The action of nitric acid, sulphuric acid, and copper, on alcohol.

1519.—Action of ethylsulphuric acid on sodium acetate.

1520.—Action of acetic acid on alcohol.

1521.—Action of nitrous acid on amyl alcohol.

1522.—Action of sodium acetate and sulphuric acid on amyl alcohol.

1523.—Action of sodium valerate and sulphuric acid on amyl alcohol.

1524.—The oxidation of amyl alcohol to valeric acid by potassium dichromate and sulphuric acid.

1525.—The action of strong nitric acid on benzine.

1526.—The formation of benzoic acid from hippuric acid and water.

1527.—The formation of sodium salicylate by the action of CO_2 on sodium phenol.

1528.—The formation of ammonium carbonate from urea and water.

1529.—The formation of lactic acid by the fermentation of milk sugar.

1530.—Show that tannic acid is gallic anhydride.

1531.—How gallic acid is split up into pyrogallic acid and water, by heat.

1532.—Show the formation of saligenin and glucose from salicin and water.

1533.—Show the relation of salicin to salicylic acid.

1534. What reaction takes place between stearin and water under strong pressure at high heat?

1535.—How is morphine converted into apomorphine?

1536.—Show the action of KOH on olein.

1537.—Give the reaction by which hydrocyanic acid is obtained from amygdalin.

1538.—Show the action of sulphuric acid on potassium ferrocyanide.

PART XVIII.

SYNTHETICAL PROBLEMS IN PHARMACEUTICAL CHEMISTRY.

1539.—How much CrO_3 can be made from $K_2Cr_2O_7$, and how much sulphuric acid will be required for the reaction?

1540.—What quantity of arsenous acid will be obtained from 100 Gm. arsenous oxide?

1541.—How much calcium hydrate will be obtained from 112 Gm. calcium oxide?

1542.—How much magnesia will be obtained from 1 pound magnesium carbonate?

1543.—What amount of zinc oxide can be obtained from 1 pound zinc carbonate?

1544.—What amount of nitric acid of 63 per cent. strength is required to make red oxide of mercury out of 1 kilogram of mercury?

1545.—What amount of corrosive sublimate will be required to make 1 pound yellow oxide of mercury?

1546.—How much potassium hydrate can be made from 500 Gm. potassium bicarbonate.

1547.—What is the per cent. of ammonium hydrate contained in the official water of ammonia?

1548.—How much ammonia will be obtained from 1 kilogram ammonium chloride?

1549.—What amount of iron is contained in the ferric hydrate produced from 500 Gm. of official solution of ferric sulphate?

1550.—How much ferric hydrate can be made of 1 kilogram solution of ferric chloride U. S. P.?

1551.—What quantity of official hydrochloric acid is required to make 100 Gm. ferrous chloride?

1552.—How much hydrochloric acid of 31.9 per cent. strength must be taken to contain 36.4 Gm. HCl?

1553.—What proportions of lithium carbonate and hydrochloric acid are necessary to make 100 Gm. lithium chloride?

1554.—What quantity of zinc chloride will be obtained by saturating 500 Gm. hydrochloric acid, and how much zinc will be consumed?

1555.—What percentage of crystallized ferric chloride can be obtained from the official solution of chloride of iron?

1556.—What is the quantity of metallic iron contained in 1 Gm. of the official solution of ferric chloride?

1557.—How much ferric chloride will be obtained from 6 molecules hydrochloric acid and 1 molecule ferric hydrate?

1558.—To what weight must a solution of ferric chloride containing 100 Gm. $Fe_2Cl_6.12H_2O$ be evaporated, in order to crystallize on standing?

1559.—What amount of official nitric acid, and how much hydrochloric acid is necessary to raise 100 Gm. crystallized ferrous chloride to ferric chloride?

1560.—How much mercury is required to make a pound of calomel?

1561.—How much bromide of potassium would be obtained by saturating 100 Gm. official hydrobromic acid with potassium carbonate?

1562.—How much bromide of potassium can be made of 1 kilogram of bromine?

1563.—What is the difference in percentage of bromine between hydrobromic acid, potassium bromide, and lithium bromide?

1564.—What is the percentage of combined iodine in the official syrup of hydriodic acid?

1565.—What proportions of sulphur and iodine are required to make I_2S_2?

1566.—How much iodine is required to make 1 kilogram potassium iodide?

1567.—What quantity of combined iodine is contained in 1 Gm. syrup of iodide of iron?

1568.—How much mercurous iodide can be made of 100 Gm. mercuric iodide, and how much more mercury must be added?

1569.—How much mercuric iodide can be made from 1 pound mercuric chloride?

1570.—What proportions of arsenic and iodine are contained in AsI_3?

1571.—What quantity of hydrocyanic acid is obtained from 10 Gm. silver cyanide when decomposed with hydrochloric acid?

1572.—What quantity of hydrocyanic acid will be obtained from 1 Gm. potassium cyanide?

1573.—How much lead nitrate is obtained from 100 Gm. lead oxide?

1574.—How much silver nitrate is obtained from 100 Gm. silver?

1575.—How much bismuth is necessary for the preparation of 1 pound of the sub-nitrate?

1576.—What is the difference in percentage of bismuth, between the sub nitrate and the sub-carbonate?

1577.—How much crystallized zinc sulphate can be obtained from 1 pound sulphuric acid containing 96 per cent. H_2SO_4, and how much zinc will be consumed?

1578.—What is the percentage of zinc in the official zinc sulphate, and what percentage in a zinc sulphate containing 5 molecules of water?

1579.—What is the difference in percentage of iron between the $FeSO_4.7H_2O$, the $FeSO_4.H_2O$, and a ferrous sulphate containing an amount of water corresponding to $1\frac{1}{2}$ molecule for each molecule of sulphate of iron?

1580.—How much ferric sulphate is obtained from 1 pound of ferrous sulphate?

1581.—If the citrate of iron be made from ferric hydrate obtained from ferric sulphate, how much ferrous sulphate will be necessary to make the ferric hydrate required for the production of 1 pound citrate of iron?

1582.—How much ammonia water of 10 per cent. strength is necessary to precipitate the ferric hydrate from 1 pound of the solution of ferric sulphate?

1583.—How much SO_2 can be obtained from each 100 Gm. of official sulphuric acid by heating with charcoal?

1584.—What quantity of metaphosphoric acid is required to form 500 Gm. of the official phosphoric acid by boiling a solution of the metaphosphoric acid?

1585.—How much phosphate of sodium can be made from a kilogram of bone ash, and how much sodium carbonate will be required?

1586.—What is the percentage of iron in soluble phosphate of iron?

1587.—What is the percentage of iron in soluble pyrophosphate of iron?

1588.—How much potassium carbonate equals 100 Gm. of potassium bicarbonate in neutralizing power?

1589.—How much sodium bicarbonate equals 100 Gm. sodium carbonate in neutralizing power?

1590.—How much magnesium carbonate equals 100 Gm. magnesia in neutralizing power?

1591.—What percentage boric acid is obtained from 100 Gm. borax by decomposition with hydrochloric acid?

1592.—What quantity of dried sodium arsenate can be made from 100 Gm. arsenous oxide?

1593.—What is the percentage of iron in the official tincture of acetate of iron?

1594.—What quantity of water is contained in the ferric hydrate obtained from 1 kilogram solution of ferric sulphate after the precipitate has been reduced to 700 Gm. by pressing out a portion of the water?

1595.—What is the percentage of lead in the official solution of sub-acetate of lead and the percentage of lead in crystallized lead acetate?

1596.—How much Rochelle salt can be made out of a pound of cream of tartar?

1597.—What is the difference in percentage of bismuth between citrate of bismuth, and citrate of bismuth and ammonium?

1598.—What quantities of sodium bicarbonate and salicylic acid are necessary to make 1 pound of a 50 per cent. solution of sodium salicylate?

1599.—How much oxygen is contained in one pound mercuric oxide?

1600.—How much oxygen, by weight, can be obtained by heating 100 Gm. $KClO_3$? How much will that oxygen measure at 15° C.? What is the residue?

1601.—What amount of hydrogen, by weight, can be obtained from 32 troy-ounces of water?

1602.—How much hydrogen gas, by weight, will be obtained from 1 kilogram diluted sulphuric acid by means of zinc? And how much Zn is consumed in decomposing that amount of the acid?

1603.—How much manganese di-oxide is consumed in generating 100 Gm. chlorine gas with HCl? And how much official hydrochloric acid?

1604.—What is the weight of the chlorine gas absorbed by one liter of water, if the water takes up 1.75 volumes?

1605.—How much HCl can be obtained from 100 ounces of NaCl, and how much H_2SO_4 is required to decompose the salt? And how much sodium sulphate, counted as anhydrous acid salt, remains?

1606.—How much diluted (U. S. P.) sulphuric acid can be made from one liter concentrated sulphuric acid of 1.835 sp. w.?

1607.—How much official acetic acid can be obtained from 1 pound of sugar of lead? How much sulphuric acid is required to decompose that amount of the sugar of lead, and what will be the weight of the lead sulphate?

1608.—How much potassium citrate can be made from 50 Gm. citric acid, and how much potassium bicarbonate is required for it?

1609.—How much lithium carbonate is required to neutralize one drachm salicylic acid?

1610.—How much silver chloride will be obtained from 10 Gm. official hydrochloric acid by precipitation with silver nitrate?

1611.—How much ferrous chloride could be made from the amount of iron contained in one pound solution of ferric chloride?

1612.—How much normal ammonium acetate is contained in a solution made from 100 Gm. official acetic acid?

1613.—How much sodium hydrate will replace 100 Gm. of KOH in precipitating mercuric oxide from $HgCl_2$?

1614.—How much ferric oxide will be obtained by igniting 100 parts ferrous oxalate?

1615.—How much $CaCl_2$ can be prepared from 100 parts $CaCO_3$, and how much official hydrochloric acid will be required?

1616.—What is the proportion of ferric phosphate in the official phosphate of iron, U. S. P., 1880?

1617.—How much precipitated ferric pyrophosphate can be made from 100 parts of the official solution of normal ferric sulphate?

1618.—How much NH_3 can be obtained from 100 parts NH_4Cl?

1619.—How much N_2O, by weight and by volume, can be obtained by the decomposition of 100 Gm of NH_4NO_3?

1620.—How much CO_2, by weight and by volume, can be obtained from: *a*) 1,000 Gm. $CaCO_3$; *b*) 1,000 Gm. $NaHCO_3$; and *c*) how much water can be saturated by that gas under the pressure of six atmospheres?

1621.—How much Sb_2O_3 and cream of tartar are required to make one pound tartar emetic?

1622.—How much manganese chloride will be formed in generating enough Cl from HCl and MnO_2 to saturate one pint of water?

1623.—What quantities of $Pb(NO_3)_2$ and KI are required to make 1,000 parts PbI?

1624.—How much O is given up by 100 grains $K_2 Mn_2O_8$ when reduced by tannin?

1625.—How much P and $Ca(OH)_2$ are required for making 1,000 Gm. $Ca(PH_2O_2)_2$?

1626.—How much acetic acid containing 36 per cent. $HC_2H_3O_2$ is required to convert into zinc acetate:—*a*) 100 parts zinc carbonate; *b*) 100 parts zinc oxide?

1627.—What is the percentage of morphine in: *a*) the sulphate, *b*) the acetate, *c*) the hydrochlorate?

1628.—What is the amount of atropine contained in 100 grains of the sulphate?

1629.—How much monohydrated quinine can be obtained from 100 grains of each of:— *a*) trihydrated quinine, *b*) the official sulphate, *c*) bisulphate, *d*) hydrobromate, *e*) valerate, *f*) hydrochlorate?

1630.—How much $CHCl_3$ may be obtained from 100 parts chloral hydrate?

1631.—How much HNO_3 can be made from 100 ℔ sodium nitrate, and how much H_2SO_4 will be required?

1632.—How much official hydrocyanic acid can be made from 1 kilogram of potassium ferrocyanide?

1633.—What is the percentage of iron in Vallet's mass?

1634.—How much HgO is obtained from 1 ℔ $HgCl_2$?

1635.—How much official solution of ferric chloride

is required to make the same quantity of ferric hydrate as would be obtained from 1 kilogram of the official solution of ferric sulphate?

1636.—What quantity of official ammonia water is required to precipitate the ferric hydrate completely from 1 kilogram of the official solution of ferric chloride?

1637.—How much Epsom salt is necessary to produce 100 ℔ of the official magnesium carbonate?

1638.—What percentage of SO_2 can be obtained from: *a*) potassium sulphite; *b*) sodium sulphite; *c*) calcium sulphite; and *d*) magnesium sulphite?

1639.—How much crystallized sodium pyrophosphate may be made from 100 ℔ of bone ash?

1640.—How much lead acetate can be made from 1,000 parts PbO, and how much official acetic acid would it require?

1641.—How much CO_2, by weight and by measure, can be made from: *a*) 100 ℔ sodium bi-carbonate; *b*) 100 ℔ chalk? And how much sulphuric acid of 1.830 sp. w. would be required for each?

1642.—How much potassium acetate can be made from 1 pound official acetic acid, and how much potassium acid carbonate would be required?

1643.—How much of the official stronger ammonia water is required to convert 1 ℔ of citric acid into di ammonium-hydrogen citrate?

1644.—What amount of antimonous oxide can be made by roasting 10 ℔s of black sulphide of antimony?

1645.—How much calcium oxide is required to make 1,000 grains of calcium hydrate?

1646.—How much official magnesium carbonate is required to make 100 Gm. magnesia.

1647.—What materials are required to make 100 ℔s red oxide of mercury from Hg and HNO_3?

1648.—What amount of citric acid is employed in preparing the official solution of citrate of magnesium over and above the quantity required to form normal magnesium citrate with the magnesium carbonate used?

1649.—What quantity of cream of tartar is required to make 100 ℔s Rochelle salt?

1650.—How much hydrochloric acid of 32 per cent. strength, and how much soda ash should be obtained from 2,000 ℔s of salt, approximately, and what other materials are necessary?

1651.—How much chalk is it necessary to decompose in order to produce the quantity of CO_2 required to convert 100 ℔s of potash into $KHCO_3$, and how much 90 per cent. sulphuric acid will be consumed?

1652.—Calculate the quantities of lime and potassium chloride required to make 100 ℔ of potassium chlorate, by Liebig's process, and the quantities of black oxide of manganese, salt and 92 per cent. sulphuric acid required to produce the chlorine for the purpose?

1653.—What quantity of anhydrous normal ferric citrate will be obtained from 100 Gm. citric acid, and how much iron will be contained in that quantity of ferric citrate?

1654.—What is the quantity of trihydrated quinine required to make 100 ounces of official citrate of iron and quinine, and how much of the official sulphate of quinine is required to produce that amount of the trihydrated alkaloid?

1655.—How much KBr is required to make 10 ℔ of 34 per cent. hydrobromic acid?

1656.—If water absorbs $2\frac{1}{2}$ times its volume of H_2S, how much ferrous sulphide and how much 92 per cent. sulphuric acid will be consumed in generating a sufficient quantity of the gas to saturate two liters of water?

1657.—What will be the percentage of hydrochloric acid present in a 63 per cent. nitric acid made from potassium nitrate containing 10 per cent. of sodium chloride?

1658.—How much potassium iodate will be formed when potassium iodide is prepared by dissolving 10 lbs of iodine in a sufficient quantity of potassium hydrate solution? How much potassium hydrate will be required, and how much potassium iodide will be obtained?

PART XIX.

ANALYTICAL PROBLEMS IN PHARMACEUTICAL CHEMISTRY.

Calculate the factors by which the quantities of compounds found by analysis must be multiplied in order to show the percentages sought of the substances indicated in the following problems:—

	Found.	*Sought.*
1659.	Ferric oxide,	Iron.
1660.	Ferric oxide,	Ferric sulphate.
1661.	Ferric oxide,	Ferric acetate.
1662.	Ferric oxide,	Ferric chloride.
1663.	Ferric oxide,	Ferric hydrate.
1664.	Ferric oxide,	Ferric nitrate.
1665.	Barium sulphate,	Sulphuric acid.
1666.	Lead sulphide,	Lead.
1667.	Calcium oxalate,	Calcium.
1668.	Silver chloride,	Chlorine.
1669.	Silver iodide,	Potassium iodide.

1670.—What is the per cent. of absolute acid in a hydrychloric acid of which 5 Gm. will saturate 30 C.c. of normal sodium hydrate solution?

1671.—What is the strength of a sulphuric acid of

which 5 Gm. will saturate 100 C.c. of normal potassium hydrate solution?

1672.—What is the strength of an acetic acid of which 25 Gm. saturates 12 Gm. potassium bicarbonate?

1673.—What is the strength of a hydrobromic acid of which 7 Gm. requires 21 C.c. of normal sodium hydrate solution for neutralization?

1674.—What is the strength of a nitric acid if 10 Gm. of it requires for neutralization 40 Gm. of sodium hydrate?

1675.—What is the strength of an ammonia solution of which 10 Gm. neutralizes 80 C.c. of normal oxalic acid solution?

1676.—What is the strength of an ammonia solution of which 11.1 Gm. will saturate 7 Gm. oxalic acid?

1677.—What is the strength of a potassium hydrate solution of which 12 Gm. saturates 1 Gm. of a 90 per cent. sulphuric acid?

1678.—What quantity of crystallized normal sodium carbonate is represented by a partly effloresced sodium carbonate of which 4 Gm. will exactly neutralize 5½ Gm. of cream of tartar known to be 99 per cent. pure?

1679.—What is the strength of a potassium hydrate solution of which 100 C.c. neutralizes 7 Gm. of citric acid?

1680.—If 2 Gm. of a sulphurous acid solution, properly diluted and mixed with starch test-solution, will require 30 C.c. of decinormal iodine solution before a permanent blue color is produced, what is the per cent. of sulphurous acid contained in that solution?

1681.—What is the percentage of pure KBr in com-

mercial potassium bromide of which 1 Gm. yields 1.45 Gm. of dry silver bromide?

1682.—What is the percentage of ferrous bromide in a syrup of bromide of iron of which 6 Gm. requires for complete precipitation 50 C.c. of decinormal silver nitrate solution?

1683.—What is the proportion of silver nitrate contained in a mixture of the nitrates of silver and potassium, if 1 Gm. of the mixture dissolved in water requires 20 C.c. of decinormal sodium chloride solution for complete precipitation?

1684.—What is the per cent. of available chlorine in a solution of chlorinated soda of which 5 Gm. mixed with a solution of 1.50 Gm. potassium iodide in 100 C.c. of water, 10 Gm. hydrochloric acid, and a sufficiency of test-solution of starch, requires exactly 40 C.c. of decinormal sodium thiosulphate solution for the discharge of the blue tint?

1685.—What is the iodine strength of an alcoholic solution of iodine of which 7 Gm., mixed with a solution of 2 Gm. KI in 30 C.c. of water and a little test-solution of starch, requires just 40 C.c. of decinormal sodium thiosulphate solution for the discharge of all color?

1686.—If 0.56 Gm. of citrate of iron be dissolved in 15 C.c. of water and 2 C.c. of hydrochloric acid, and, after the addition of 1 Gm. of KI and a few drops of test solution of starch, the mixture should require just 18 C.c. of decinormal thiosulphate solution for the discharge of the blue or greenish color, what is the per cent. of iron contained in the scale salt?

1687.—If 0.50 Gm. of dry KBr dissolved in 10 C.c. of water, and with 2 drops of potassium chromate test-

solution added, require just 30 C.c. of decinormal silver nitrate solution to produce a permanent red color of silver chromate, what is the per cent. of KCl contained in the bromide?

1688.—If 2 Gm. of sodium acetate completely decomposed at red heat, the residue dissolved in water, and a few drops of methyl orange T. S. added, require 14 C.c. of normal sulphuric acid V. S. for exact neutralization, what is the percentage of $NaC_2H_3O_2.3H_2O$ in the sample?

1689.—What is the proportion of ferrous sulphate, counted as crystallized salt, contained in a sample of sulphate of iron of which 4.161 Gm. dissolved in water and acidulated with diluted H_2SO_4, requires 49.50 C.c. of decinormal potassium dichromate V. S. to prevent further reaction for ferrous salt with T. S. of potassium ferricyanide?

1690.—What is the per cent. of NH_3 in a spirit of ammonia of which 3.4 Gm. requires 32 C.c. of normal sulphuric acid (V. S.) for exact neutralization?

1691.—What is the per cent. strength of an acetic acid of which 6 Gm. requires 60 C.c. of normal potassium hydrate solution for exact neutralization?

1692.—What is the per cent. strength of a sodium hydrate solution of which 20 Gm. requires 20 C.c. of normal hydrochloric acid for exact neutralization?

1693.—What is the per cent. strength of a nitric acid of which 3.15 Gm requires 31.50 C.c. of normal potassium hydrate solution for exact neutralization?

1694.—What is the per cent. strength of a phosphoric acid of which 4.9 Gm. requires 49 C.c. of normal potassium hydrate solution for exact neutralization?

PART XX.

DIMENSIONS, SURFACE AND CAPACITY.

RULE I.—To find the area of a circle, the diameter being known:—*Multiply the square of ½ the diameter by 3.1416.*

RULE II.—To find the diameter of a circle, the area of which is known:—*Divide the area by 3.1416; the square root of the quotient is equal to ½ the diameter.*

RULE III.—To find the solidity of a prism or cylinder:—*Multiply the area of the base by the perpendicular height.*

RULE IV.—To find the solidity of any pyramid or cone:—*Multiply the area of the base by ⅓ of the altitude.*

RULE V.—To find the solidity of the frustrum of a pyramid or of a cone:—*Multiply the areas of the two bases together, and extract the square root of the product. This root is the area of a base which is a mean between the other two. Take the sum of the areas of the three bases, and multiply it by ⅓ of the altitude. The product is the solidity of the frustrum.*

RULE VI.—To find the solidity of a sphere:—*Multiply the cube of the diameter by 3.1416, and divide the product by 6;* or

Multiply the area of the surface by ⅙ of the diameter.

1695.—What is the area of a spread plaster in circular form, the diameter of which is 30 centimeters?

1696.—What is the square surface of a filter paper of 6 inches diameter?

1697.—What is the diameter of a circular blister measuring 3 square inches?

1698.—What is the capacity of a cylindrical tincture bottle of 6 inches internal diameter and 12 inches height?

1699.—What is the capacity of a funnel of 6½ inches internal diameter at the top, and measuring 5½ inches inside from the top to the throat?

1700.—What is the capacity of a cylindrical percolator 12 inches high and of 2 inches internal diameter?

1701.—What is the capacity of a cylindrical percolator 12 inches high and of 2½ inches internal diameter?

1702.—What is the capacity of a conical percolator 1½ inches in diameter at the bottom, 2 inches diameter at the top, and 10 inches high, inside measurements?

1703.—What is the solidity of a globe 10 inches in diameter?

PART XXI.

LATINIC AND ENGLISH TECHNICAL PHARMACEUTICAL NOMENCLATURE.

NOUNS.

Terminations of the genitive, singular and plural:—

Declension.	Terminations. Genitive Singular.	Genitive Plural.
1	**-æ, or -es.**	**-arum.**
2	**-i.**	**-orum.**
3	**-is.**	**-um, or -ium.**
4	**-us.**	**-uum.**
5	**-ei.**	**-erum.**

EXAMPLES.

FIRST DECLENSION.

Singular.		*Plural.*	
Nom.	*Gen.*	*Nom.*	*Gen.*
Hérba	Hérbæ	Hérbæ	Herbárum
Pílula	Pílulæ	Pílulæ	Pilulárum
Tinctūra	Tinctúræ	Tinctúræ	Tincturárum
Rósa	Rósæ	Rósæ	Rosárum
Céra	Céræ	....	....
Aloe	Aloes	....	....
Chimáphila	Chimáphilæ	....	....
Cimicífuga	Cimicífugæ	....	....

Nouns ending in *-a* or *-e* in the nominative singular follow the first declension and are of the feminine gender. The nominative plural ends in *-æ*; the genitive plural in *-arum.*

SECOND DECLENSION.

Singular.		*Plural.*	
Nom.	*Gen.*	*Nom.*	*Gen.*
Bólus	Bóli	Bóli	Bolórum
Syrúpus	Syrúpi	Syrúpi	Syropórum
Trochíscus	Trochísci	Trochísci	Trochiscórum
Ácidum	Ácidi	Ácida	Acidórum
Vínum	Víni	Vína	Vinórum
Cerátum	Ceráti	Ceráta	Cératórum
Fólium	Fólií	Fólia	Foliórum
Coníum	Coníi	....	....
Prínos	Príni	....	....
Rícinus	Rícini	....	....
Diospýros	Diospýri	....	....
Erythróxylon	Erythróxyli	....	....
Hæmatóxylon	Hæmatóxyli	....	....

Nouns ending in *-us* or *-os* following this declension are masculine, with the exception of juníperus, prúnus, sambúcus and ulmus, which are feminine. Those ending in *-um* or *-on* are neuter. The nominative plural masculine ends in *-i*, neuter in *-a.*

It will be seen that a large number of titles of familiar drugs and chemical compounds and the generic titles of various preparations are of this declension, as: – ácídum, óxidum, súlphidum, chlóridum, brómidum, iódidum, cyánidum, cerátum, unguéntum, infúsum, decóctum, liniméntum, emplástrum, extráctum; etc.

Third Declension.

Singular.		*Plural.*	
Nom.	*Gen.*	*Nom.*	*Gen.*
Pars	Pártis	Pártes	Pártium
Cítras	Citrátis	Citrátes	Citrátum
Acétas	Acetátis	Acetátes	Acetátum
Súlphas	Sulphátis	Sulphátes	Sulphátum
Súlphis	Sulphítis	Sulphites	Sulphitum
Nítris	Nitrítis	Nitrites	Nitritum
Arsénas	Arsenátis	Arsenátes	Arsenátum
Arsénis	Arsenítis	Arsenítes	Arsenítum
Púlvis	Púlveris	Púlveres	Púlverum
Líquor	Liquóris	Liquóres	Liquórum
Lótio	Lotiónis	Lotiónes	Lotiónum
Emúlsio	Emulsiónis	Emulsiónes	Emulsiónum
Mucilágo	Muciláginis	Mucilágines	Muciláginum
Sápo	Sapónis	Sapónes	Sapónum
Stígma	Stigmátis	Stigmata	Stigmátum
Énema	Enématis	Enémata	Enématum
Túber	Túberis	Túbera	Túberum
Rádix	Radícis	Radíces	Radícium
Córtex	Córticis	Córtices	Cortícium
Flos	Flóris	Flóres	Flórum
Opus	Operis	Opera	Operum
Sémen	Séminis	Sémina	Séminum
Stípes	Stípitis	Stípites	Stípitum
Súmmitas	Summitátis	Summitátes	Summitátum
Bórax	Borácis	....	....
Cálx	Cálcis	....	....
Rúmex	Rumícis	....	....
Pix	Pícis	....	....
Mácis	Mácidis	....	....

Singular.		*Plural.*	
Nom.	*Gen.*	*Nom.*	*Gen.*
Bérberis	Berbérides	....	....
Adeps	Adípis	....	....
Asclépias	Asclepíadis	....	....
Júglans	Juglándis	....	....
Píper	Píperis	....	....
Zíngiber	Zingíberis	....	....
Mél	Méllis	....	....
Sal	Sális	....	....
Mas	Máris	....	....
Lac	Láctis	....	....
Digitális	Digitális	....	....
Alúmen	Alúminis	....	....
Rhus	Rhóis	....	....
Erígeron	Erigeróntis	....	....
Sinápis	Sinápis	....	....

Nouns following the third declension have a great variety of terminations in the nominative singular, and they may be of any of the three genders.

The nominative plural ends in *-es*, *-a*, or *-ata*, and the genitive plural in *-um* or *-ium*.

It will be seen that the nouns used as titles for the oxy-salts, such as súlphas, nítras, carbónas, phósphas, and nítris, hypophósphis, etc., are of the third declension.

Fourth Declension.

Singular.		*Plural.*	
Nom.	*Gen.*	*Nom.*	*Gen.*
Spíritus	Spíritus	Spíritus	Spírituum
Frúctus	Frúctus	Frúctus	Frúctuum
Córnus	Córnus	....	....
Quércus	Quércus	....	....

The four nouns named above are the only ones of the

fourth declension commonly occuring in pharmaceutical nomenclature.

FIFTH DECLENSION.

The only noun of the fifth declension used in pharmaceutical terminology is the title *Spécies*, which is plural; the genitive is *speciérum.*

INDECLINABLE NOUNS.

Several of the titles of drugs are indeclinable nouns, as:—álcohol, ámyl, azédarach, búchu, cátechu, cóca, curáre, élemi, éthyl, jaborándi, kamála, kíno, kóusso, mático, ménthol, méthyl, phénol, phényl, ságo, sássafras, súmbul and thýmol.

The genitives are used in formulas, prescriptions, titles composed of two nouns, and in other instances where the possessive or genitive case is employed or understood. The English phrase: "Take of Rhubarb, one ounce," is rendered in Latin thus:— *Recipe: Rhéi, unciam unam.* "Rhéi," is the genitive of *Rhéum*, rhubarb. The title "Tincture of Rhubarb" is in Latin *Tinctúra Rhéi.* A prescription calling for two drachms of Tincture of Rhubarb would read:—

℞ Tinctúræ, Rhéi, dráchmas dúas.

[But quantities are nearly always, and most conveniently and properly expressed in symbols and characters or numerals, and not in words, so that *unciam unam* is written ℥j, and *drachmas duas* is written ʒij.]

Examples of the use of the genitive:—

Amygdala means almond; its genitive is *amydalæ; oleum amygdalæ*, means oil of almond. *Oleum Amygdalárum* means oil of almonds.

Arnica means arnica; *Arnicæ Radix* means arnica root or root of arnica; *Arnicæ Flóres* means arnica flowers; and *Tinctúra Arnicæ* means tincture of arnica.

ADJECTIVES.

The adjectives common to pharmaceutical nomenclature follow the first declension when of the feminine form and ending in *-a*, as *púra;* the second declension when of the masculine form and ending in *-us*, as *púrus*, or when neuter and ending in *-um*, as *púrum;* they follow the third declension when of the masculine form and ending in *-er*, as in *rúber*, or in *-is*, as in *mítis* and *fórtis;* when feminine and ending in *-is*, as in *mitis* and *fortis;* and when neuter and ending in *-e*, as in *míte* and *fórte*.

Certain adjectives ending with *s* or *x* in the nominative singular have the same ending for all three genders in both nominative and genitive of the singular number, as in the adjective *símplex;* but the nominative plural is *símplices* for the masculine and feminine form, and *simplícia* in the neuter, while the genitive plural is *simplícium* for all three genders.

In the comparative degree the adjectives have the endings *-ior* in the masculine and feminine forms, and *-ius* in the neuter, singular number, following the third declension; and in the superlative degree they have the ending *-issimus* for the masculine, and *-issimum* for the neuter, both following the second declension, while the feminine form ends in *-issima*, following the first declension. Thus the comparative and superlative adjectives follow the same rules as the adjectives in the positive degree, as to declension.

PREPOSITIONS.

The prepositions *cum* (with), *de* (from or concerning), *e* or *ex* (from, or out of), *in* (in), *pro* (for), and *sine* (without), are followed by the ablative case. The ablative singular of the first declension is like the nominative; the ablative singular of nouns of the second declension ends in *-o;* nouns of the third declension generally form the ablative singular with the ending *-e*, but some have the ending *-i*.

ABBREVIATION.

Each word is divided into as many syllables as there are vowels or diphthongs; it follows that whenever two vowels, or one vowel and one diphthong, or two diphthongs follow each other, the last of them begins a new syllable. Syllables may also begin with a vowel or diphthong in compound words, because such words must be so divided as to show the component parts. But in all other cases any syllable after the first begins with one or more consonants. The letter *u* preceded by a consonant and followed by a vowel when pronounced like *v* is to be treated as if it were a consonant. When one consonant stands alone it must be joined to the next following vowel. When two or more consonants stand together between two vowels, as many are joined to the next following vowel as can be pronounced with it, except when the preceding vowel is short and accentuated, in which case one of the consonants is joined to that vowel, as in *myrística*, which is divided and pronounced mў-rĭs-tĭcă.

The last letter in any abbreviation of a word must be a consonant, and that consonant, too, must be one followed

by a vowel when the word is spelled out in full. Thus—*Sacch.* is a proper abbreviation of Săc-chă-rŭm, while *Sac.* and *Saccha.* would be improper.

A properb abreviation is always sufficient to indicate clearly the word it represents; any abbreviation which is ambiguous or which does not at once indicate the word it stands for, is an improper one. Thus, in pharmaceutical nomenclature, *Tinct.* is a proper abbreviation of the title Tinctúra, and *Trit.* is a proper abbreviation of the title Triturātio; but *Tr* is an improper abbreviation of either.

Any abbreviation which is at all liable to be misinterpreted, or not understood, is an inadmissible abbreviation.

Any abbreviation which omits only a terminal vowel or diphthong must also be regarded as improper. Thus it is improper to write *Pilul.* for *Pilulæ*, or *Acid.* for *Acidi.*

In abbreviating words of two or three syllables it is permissible to omit the last two letters, only, as in *Pulv.* for *Púlvis*, *Mit.* for *Mítis*, or *Calc.* for *Cálcii*; but, as a rule, words of less than three syllables should not be abbreviated, and no abbreviation ought to be made unless it be a material one. Thus *Empl.* for *Emplástri* is good, but such an abbreviation as *Emplastr.* would be absurd.

An abbreviation which may be ambiguous when considered alone, may nevertheless be proper if used in such a connection that its meaning is rendered entirely unambiguous by the context. Thus *Hydr. Chlor.* is quite improper, as it may stand for either

calomel, corrosive sublimate, or chloral hydrate; but *Hydr. Chlor. Corros.* is a proper abbreviation.

The following examples are given to show the application of the foregoing rules:—

Word Abbreviated.	*Abbreviations.* *Good.*	*Bad.*	*Indifferent.*
Absínthii	Absinth.	Abs.	....
	....	Absinthí.	....
Abstrácti	Abstr.	Abs.	....
	....	Abst.	....
	....	Abstract.	....
Acáciæ	Acac.	Ac.	....
	....	Acaci.	....
Acéti	....	Ac.	....
	....	Acet.	....
Aconíti	Acon.	Ac.	....
	....	Aconit.	....
Alúminis, or	Alum.	Al.	....
Alúmini	....	Alumin.	....
Antimóni	Antim.	Ant	....
	....	Antimon.	....
Áquæ	....	Aq.	....
	....	Aqu.	....
Cámphoræ	Camph.	Cam.	....
	....	Camphor.	....
Chlorofórmi	Chlorof.	Chlor.	....
	....	Chloroform.	....
Cólchici	Colch.	Col.	....
	....	Colchic.	....
Extrácti	Extr.	Ex.	....
	....	Ext.	....
	....	Extract.	....

Word Abbreviated.	*Abbreviations.* *Good.*	*Bad.*	*Indifferent.*
Férri	....	Fer.	....
	....	Ferr.	....
Hydrárgyri	Hydrarg.	Hyd.	Hydr.
	....	Hydrargyr.	....
Infúsi	Inf.	Infus.	....
Liniménti	Linim.	Liniment.	Lin.
Liquóris	Liqu.	Liq.	Liquor.
Mistúræ	Mist.	Mis.	....
	....	Mistur.	....
Pílula	Pil.	Pilul.	....
Pilulárum	Pil.	....	Pilular.
	Pilul.	....	....
Púlvis	....	Pul.	Pulv.
Púlveris	Pulv.	Pul.	Pulver.
Spíritus	Spir.	Sp.	Spirit.
	....	Spt.	....
	....	Spts.	....
Símplicis	Simpl.	Simp.	....
	....	Simplic.	....
Tinctúræ	Tinct.	Tinc.	....
	....	Tr.	....
	....	Træ.	....
Unguénti	Ungu.	Ung.	....
	....	Unguent.	....

Write in full the genitives of the following Latinic titles; also translate these titles into their proper technical American titles, and give the common vernacular names, if any, of the substances mentioned:—

1704.—Absínthium, Aconítum, Allium, Althæa, Adeps.

1705.—Ánthemis, Apócynum, Asclépias, Aspídium.

1706.—Azédarach, Brayéra, Bryónia, Búchu.

1707.—Cálamus, Caléndula, Calúmba, Cambógia.

1708.—Cánnabis Americána, Cánnabis Indica, Cántharis.

1709.—Cápsicum, Cardamómum, Cárum, Caryophýllus.

1710.—Cáscarílla, Cássia Fístula, Castánea, Caulophýllum.

1711.—Cetrária, Chelidónium, Chenopódium, Chimáphila.

1712.—Chiráta, Chóndrus, Cimicífuga, Coníum.

1713.—Córnus, Crócus, Cydónium, Cypripédium.

1714.—Digitális, Dúlcamára, Erythróxylon, Euónymus.

1715.—Eupatórium, Fícus, Fœnículum, Frángula.

1716.—Gálla, Gaulthéria, Gelsémium, Gentiána.

1717.—Geránium, Glycyrrhíza, Gossýpium, Granátum

1718.—Grindélia, Guarána, Hæmatóxylon, Hamamélis.

1719.—Hedeóma, Húmulus, Hydrástis, Hyoscýamus.

1720.—Ignátia, Illícium, Ínula, Ipecacuánha.

1721.—Íris, Jalápa, Júglans, Juníperus.

1722.—Kamála, Kraméria, Láppa, Leptándra.

1723.—Línum, Lobélia, Lupulínum, Lycopódium.

Write in full the genitives of the following Latinic titles; also translate these titles into their proper technical American titles, and give the common vernacular names, if any, of the substances mentioned:—

1724.—Mácis, Magnólia, Marrúbium, Mático.

1725.—Matricária, Melíssa, Menispérmum, Mentha Víridis.

1726.—Mezéreum, Myrística, Nux Vómica, Oríganum.

1727.—Paréira, Pépo, Physostígma, Pilocárpus

1728.—Piménta, Píper, Podophýllum, Prínos.

1729.—Prúnum, Prúnus Virginiána, Púlsatílla.

1730.—Pyréthrum, Quássia, Quércus Alba, Quilláia.

1731.—Rhéum, Rhus Glábra, Rhus Toxicodéndron, Rósa Céntifolia, Rosa Gállica.

1732.—Rosmarínus, Rúbus, Rúbus Idæus.

1733.—Rúmex, Sabína, Sálix, Sálvia.

1734.—Sambúcus, Sanguinária, Sántalum Rúbrum, Santónica.

1735.—Sarsaparílla, Sássafras, Sássafras Medúlla, Scílla.

1736.—Scopárius, Scutellária, Sénega, Sénna.

1737.—Serpentária, Spigélia, Staphiságria, Stillíngia.

1738.—Stramónii Fólia, Stramónii Sémen, Súmbul, Tamaríndus.

1739.—Tanacétum, Taráxacum, Thúja, Tríticum.

1740.—Úlmus, Ustilágo, Úva Úrsi, Valeriána, Vanílla.

1741.—Verátrum Víride. Vibúrnum, Víola Trícolor, Xanthóxylum, Zíngiber.

1742.—Aspidospérma, Asárum, Baptísia, Bóldus.

1743.—Catária, Chelóne, Chionánthus, Collinsónia.

1744.—Alétris, Corýdalis, Damiána, Delphínium.

1745.—Dioscoréa, Drósera, Epigæá, Eriodíctyon.

Write in full the genitives of the following Latinic titles; also translate these titles into their proper technical American titles, and give the common vernacular names, if any, of the substances mentioned:—

1746.—Fúcus Vesiculósus, Géum, Gillénia, Gnaphálium.

1747.—Heliánthemum, Helónias, Hepática, Heuchéra.

1748.—Juníperus Virginiána, Lactcúa, Leonúrus, Lycópus.

1749.—Methýsticum, Mitchélla, Mýrica, Œnóthera.

1750.—Phoradéndron, Piscídia, Polýmnia, Ptélea.

1751.—Rhámnus Purshiána, Rhús Aromática, Senécio.

1752.—Simarúba, Solidágo, Spiræ̃a, Sýmphytum.

1753.—Tríllium, Tussilágo, Verbáscum, Vibrúnum Ópulus.

Give the proper latinic titles with genitives, and also the proper English chemical names of the following:—

1754.—Kálium; Nátrium; Stíbium.

1755.—Argéntum; Plúmbum; Hydrárgyrum; Aúrum.

1756.—Cúprum; Mangánum; Arsénum; Carbóneum.

1757.—Ácidum Phenýlicum; Ácidum Carbazóticum; Ácidum Azóticum.

1758.—Ácidum Muriáticum; Ácidum Prússicum; Ácidum Hydrocyánicum.

1759.—Ácidum Hydrochlorátum; Ácidum Hydrobromátum; Ácidum Hydrocyanátum.

1760.—Ácidum Bóricum; Óxidum Arsenósum.

1761.—Zínci Óxidum; Plúmbum Oxydátum; Óxidum Cálcicum.

Give the proper latinic titles with genitives, and also the proper English chemical names of the following:—

1762.—Férrum Oxydátum Saccharátum Solúbile.

1763.—Hydrárgyrum Oxydátum Rúbrum; Antimonósum Óxidum.

1764.—Hýdras Kálicus; Nátricus Hýdras.

1765.—Hýdras Férricus; Alúmini Hýdras.

1766.—Óxidum Magnésicum; Argénticum Óxidum; Férri Óxidum Magnéticum.

1767.—Ammónium Chlorátum; Kálium Iodátum; Nátrium Bromátum.

1768.—Férrum Sesquichlorátum; Chlorétum Férricum; Chlorurétum Férricum.

1769.—Férri Chlóridum; Férricum Chlóridum.

1770.—Ferrósum Chlóridum; Férri Chlóridum Víride.

1771.—Hydrargyrósum Chlóridum; Hydrargýricum Iódidum.

1772.—Hydrárgyri Bichlóridum; Hydrárgyri Subchlóridum.

1773.—Férrum Sulfúricum Oxydátum; Chinínum Ferro-cítricum.

1774.—Hydrárgyrum Bichlorátum: Hydrárgyrum Bijodátum.

1775.—Férri Perchlóridum; Ferrósum Iódidum.

1776.—Chlorétum Stíbicum; Kálium Cyanátum.

1777.—Cálomel; Potássa; Calcária Ústa; Alúmen Ústum.

1778.—Calx Vívum; Magnésia Lévis; Magnésia Ústa.

1779.—Hydrátocarbónas Magnésicus; Chloréto-Amidétum Hydrargýricum.

1780.—Chlóridum Nátricum; Potássicum Cyánidum.

Give the proper latinic titles with genitives, and also the proper English chemical names of the following:—

1781.—Nítras Kálicus; Kálium Nítricum; Potássii Nítras; Potássicus Nítras.

1782.—Chlóras Kálicus; Kálium Chlóricum; Sódicus Chlóras.

1783.—Súlphas Zíncicus; Zíncum Sulfúricum; Zíncicus Súlphas.

1784.—Ferrósus Súlphas; Férricus Súlphas; Férricus Subsúlphas.

1785.—Ferrósus Carbónas Saccharátus; Sódicus Bicarbónas; Bicarbónas Nátricus.

1786.—Nátrium Phosphóricum· Sódii Bibóras; Kálicus Permangánas.

Write in full the nominative and genitive of the pharmacopœial latinic titles of:—

1787.—Chlorine; Iodine; Bromine.

1788.—Sulphur; Phosphorus; Carbon.

1789.—Arsenic; Antimony; Bismuth.

1790.—Zinc; Lead; Copper.

1791.—Gold; Silver; Mercury.

1792.—Manganese; Iron.

1793.—Acid; Acids.

1794.—Acetic Acetic; Diluted Acetic Acid; Glacial Acetic Acid.

1795.—Valeric Acid; Oleic Acid; Lactic Acid.

1796.—Oxalic Acid; Tartaric Acid; Citric Acid.

1797.—Pure Phenol; Crude Phenol; Picric Acid; Salicylic Acid; Benzoic Acid.

1798.—Tannic Acid; Gallic Acid.

Write in full the nominative and genitive of the pharmacopœial latinic titles of:—

1799.—Hydrochloric Acid; Hydrobromic Acid; Hydriodic Acid; Hydrocyanic Acid; Nitrohydrochloric Acid; Diluted Hydrochloric Acid.

1800.—Nitric Acid; Diluted Nitric Acid; Sulphuric Acid; Aromatic Sulphuric Acid; Phosphoric Acid.

1801.—Carbonic Acid; Boric Acid.

1802.—Arsenous Anhydride; Chromic Anhydride; Sulphurous Anhydride.

1803.—Water; Potassium Hydrate; Sodium Hydrate; Ammonia.

1804.—Lime; Magnesia; Zinc Oxide.

1805.—Lead Oxide; Silver Oxide.

1806.—Red Oxide of Mercury; Yellow Oxide of Mercury.

1807.—Aluminum Hydrate; Black Oxide of Manganese; Antimonous Oxide.

1808.—Oxide; Hydrate.

1809.—Chloride; Iodide; Bromide; Cyanide.

1810.—Sulphide; Phosphide.

1811.—Nitrate; Nitrites.

1812.—Chlorate; Hypochlorite.

1813.—Sulphate; Sulphite; Hyposulphite.

1814.—Phosphate; Pyrophosphate; Hypophosphite.

1815.—Borate; Silicate; Carbonate; Bicarbonate.

1816.—Permanganate; Chromate; Arsenate; Arsenite.

1817.—Acetate; Valerate; Oleate; Lactate.

1818.—Oxalate; Tartrate; Bitartrate; Citrate.

1819.—Picrate; Salicylate; Benzoate.

1820.—Tannate; Santoninate.

Write in full the nominative and genitive of the pharmacopœial latinic titles of:—

1821.—Potassium, Sodium, Lithium and Ammonium Chlorides.

1822.—Barium, Calcium, Magnesium and Zinc Chlorides.

1823.—Calomel; Corrosive Sublimate.

1824.—Ferrous Chloride; Ferric Chloride.

1825.—Chloride of Antimony; Oxychloride of Antimony; Chloride of Gold and Sodium.

1826.—Potassium, Sodium, and Ammonium Iodides.

1827.—Calcium Iodide; Zinc and Cadmium Iodides.

1828.—Lead and Silver Iodides.

1829.—Green Iodide of Mercury; Red Iodide of Mercury.

1830.—Iodide of Iron; Iodide of Arsenic; Saccharated Iodide of Iron.

1831.—Potassium, Sodium, Lithium and Ammonium Bromides.

1832.—Calcium, Magnesium, and Iron Bromides.

1833.—Potassium, Silver, Mercury and Zinc Cyanides.

1834.—Ferrocyanide of Potassium; Ferrocyanide of Iron.

1835.—Potassium, Sodium, and Ammonium Sulphides.

1836.—Mercury, Iron, and Antimony Sulphides.

1837.—Sulphurated Potassa; Sulphurated Lime; Sulphurated Antimony.

1838.—Potassium, Sodium, and Ammonium Nitrates; Barium Nitrate.

Write in full the nominative and genitive of the pharmacopœial latinic titles of:—

1839.—Lead, Copper, Silver, and Mercury Nitrates.

1840.—Nitrate of Iron; Subnitrate of Bismuth.

1841.—Potassium, Sodium, and Ammonium Sulphates.

1842.—Calcium, Magnesium, Zinc, and Cadmium Sulphates.

1843.—Copper, and Manganese Sulphates.

1844.—Sulphate of Mercury; Yellow Sulphate of Mercury.

1845.—Aluminum Sulphate; Aluminum and Potassium Sulphate; Aluminum and Ammonium Sulphate.

1846.—Alum; Dried Alum.

1847.—Ferrous Sulphate; Dried Ferrous Sulphate; Precipitated Ferrous Sulphate.

1848.—Normal Ferric Sulphate; Basic Ferric Sulphate; Iron Alum.

1849.—Potassium, Sodium, Calcium, and Magnesium Sulphites.

1850.—Sodium, and Ammonium Phosphates.

1851.—Precipitated Phosphate of Calcium.

1852.—Blue Phosphate of Iron; White Phosphate of Iron; Soluble Phosphate of Iron.

1853.—Potassium Pyrophosphate; Pyrophosphate of Sodium.

1854.—Precipitated Pyrophosphate of Iron; Soluble Pyrophosphate of Iron.

1855.—Potassium, Sodium, Lithium, and Ammonium Hypophosphites.

1856.—Calcium, Magnesium, Manganese, and Iron Hypophosphites.

Write in full the nominative and genitive of the pharmacopœial latinic titles of:—

1857.—Potassium Carbonate; Sodium Carbonate: Dried Sodium Carbonate.

1858.—Lithium Carbonate; Ammonium Carbonate.

1859.—Precipitated Calcium Carbonate; Magnesium Carbonate; Zinc Carbonate.

1860.—Lead Carbonate; Subcarbonate of Iron; Saccharated Carbonate of Iron; Subcarbonate of Bismuth.

1861.—Bicarbonate of Potassium: Bicarbonate of Sodium.

1862.—Potassium, Sodium, and Ammonium Acetates.

1863.—Zinc, Lead, and Copper Acetates.

1864.—Acetate of Iron; Subacetate of Copper.

1865.—Phosphide of Zinc; Nitrite of Potassium.

1866.—Hypochlorite of Potassium; Hyposulphite of Sodium.

1867.—Borax; Potassium Permanganate; Chromate and Bichromate of Potassium.

1868.—Arsenate of Sodium; Arsenate of Iron; Arsenite of Potassium; Arsenite of Copper.

1869.—Sodium, and Ammonium Valerate; Ferrous Lactate; Zinc Lactate.

1870.—Oleate of Mercury; Oleate of Zinc; Oleate of Lead.

1871.—Oleate of Iron; Succinate of Ammonium; Sulphocarbolate of Zinc.

1872.—Potassium Tartrate; Potassium and Sodium Tartrate; Potassium Bitartrate; Tartrate of Antimony and Potassium.

Write in full the nominative and genitive of the pharmacopœial latinic titles of:—

1873.—Tartrate of Iron and Potassium; Tartrate of Iron and Ammonium.

1874.—Citrate of Potassium; Citrate of Lithium; Citrate of Ammonium; Citrate of Magnesium.

1875.—Citrate of Iron; Citrate of Iron and Ammonium; Citrate of Iron and Quinine; Citrate of Iron and Strychnine.

1876.—Ammonium Picrate; Sodium Salicylate; Ammonium Benzoate; Santoninate of Sodium.

1877.—Mercury with Chalk; Potassa with Lime.

Translate the following terms into English; and state number and gender:—

1878.—Commúnis, Venále, Crúdus, Impúrus.

1879.—Purus, Bónus, Óptimum, Depuráta, Purificátum, Lótus, Véra, Rectificátus.

1880.—Mágnus, Párvum, Lónga, Brévis.

1881.—Ínteger, Incísa, Concísum, Contúsus, Pulverátus, Púlvis Gróssus, Púlvis Súbtilis, Pulvís Subtilíssimus, Rásus.

1882.—Álbus, Rúber, Nígra, Cœrúleum, Fláva, Fúscus, Víride, Decoloráta.

1883.—Síccus, Desiccátum, Exsiccáta, Fúsus, Sólida, Líquida, Húmidus.

1884.—Dúrus, Móllis, Fílum, Volatília, Lévis, Ponderósa.

1885.—Granulátus, Præcipitátus, Turbidátus, Sublimátum, Distilláta, Crystallisáta.

Translate the following terms into English; and state number and gender:—

1886.—Expréssa, Solúbile, Coláta, Compréssæ, Inspissátus.

1887.—Dilútus, Concentráta, Fórte, Dúlcis, Ácre, Mítis, Corrosívus, Fórtior, Ténuis, Amára, Aromáticus.

1888.—Símplex, Compósitum, Aquósus, Alcohólica, Spirituósum, Oleósa, Æthérea, Ammoniátus.

Translate into English:—

1889.—*a*) Ad. *b*) Ex. *c*) Et. *d*) Cum. *e*) Síne *f*) Ana. *g*) Pro. *h*) Ut. *i*) In. *k*) Per. *l*) Vel. *m*) Deínde.

1890.—*a*) Adde. *b*) Béne. *c*) Bis. *d*) Ter. *e*) In duplo. *f*) Partes æquáles.

1891.—*a*) Fac. *b*) Fíat. *c*) Fíant. *d*) Mísce. *e*) Mítte.

1892.—*a*) Da. *b*) Détur. *c*) Dívide. *d*) Quántum satis. *e*) Quantum súfficit. *f*) Táles dóses. *g*) Número. *h*) Hóra.

1893.—*a*) Ad líbitum. *b*) Pro re nata. *c*) Singulórum. *d*) Secúndum Artem. *e*) Ut fiat. *f*) Tere. *g*) Tritúra. *h*) Sólve. *i*) Cóque. *k*) Cóla.

Translate the following:—

1894.—*a*) Sígna. *b*) Súmat. *c*) Cápiat. *d*) Cíto. *e*) Státim. *f*) Cóchlear. *g*) Chártula. *h*) Scátula.

Translate the following:—

1895. *a*) Mistúra. *b*) Haústus. *c*) Pótus, or Pótio. *d*) Gúttæ. *e*) Gargarísma. *f*) Lótio. *g*) Injéctio. *h*) Énema. *i*) Collýrium. *k*) Collunárium. *l*) Cataplásma.

1896.—*a*) Únus. *b*) Duo. *c*) Tres. *d*) Quátuor. *e*) Sex. *f*) Quinque. *g*) Octo. *h*) Décem *i*) Nóvem. *k*) Septem. *l*) Duódecim.

1897.—*a*) Bis. *b*) Ter. *c*) Primus. *d*) Secúndus) *e*) Tértius. *f*) Quártus. *g*) Quintus. *h*) Sextus. *i*) Atlérnis horis. *k*) Sémis. *l*) Dimídius.

Write in full the nominative and genitive of the pharmacopœial latinic titles of:—

1898.—Washed Sulphur; Purified Mercury: Iodized Starch.

1899.—Purified Sulphide of Antimony; Diluted Nitrate of Silver; Fused Nitrate of Silver.

1900.—Prepared Chalk; Saccharated Carbonate of Iron; Saccharated Iodide of Iron.

1901.—Hydrated Oxide of Iron with Magnesia: Reduced Iron.

1902.—Corrosive Chloride of Mercury: Mild Chloride of Mercury.

1903.—Red Iodide of Mercury; Green Iodide of Mercury; Ammoniated Mercury.

1904.—Granulated Citrate of Magnesium: Granulated Zinc.

1905.—Sulphurated Potassa; Sulphurated Lime; Sulphurated Antimony.

Write in full the nominative and genitive of the pharmacopœial latinic titles of:—

1906.—Crude Carbolic Acid; Commercial Bicarbonate of Sodium.

1907.—Fused Nitrate of Silver; Fused Chloride of Calcium; Fused Chloride of Zinc.

1908.—Calcined Bone; Burnt Alum; Burnt Magnesia; Sublimed Sulphur.

1909.—Dialysed Iron; Pure Zinc; Pure Carbonate of Potassium.

1910.—Crystallized Nitrate of Silver; Crystallized Sulphide of Mercury.

1911.—Heavy Magnesia; Resublimed Iodine.

1912.—Precipitated Oxide of Mercury; Precipitated Sulphate of Iron.

1913.—Quinine; Strychnine; Morphine; Veratrine.

1914.—Salicin; Santonin; Aloin; Saponin; Elaterin; Pricotoxin; Lupulin.

1915.—Ether; Acetic Ether; Stronger Ether.

1916.—Alcohol; Diluted Alcohol; Amylic Alcohol; Absolute Alcohol.

1917.—Creasote; Glycerin; Starch; Sugar; Milk Sugar; Pepsin.

1918.—Chloral; Chloroform; Iodoform; Amyl Nitrite; Ethereal Oil of Wine.

1910.—Quinine Sulphate; Morphine Acetate; Hyoscyamine Salicylate.

1920.—Quinine Hydrobromate; Morphine Hydrochlorate.

1921.—Phyostigmine Salicylate; Hyoscyamine Sulphate.

1922.—Cocaine Hydrochlorate; Strychnine Nitrate.

Write in full the nominative and genitive of the pharmacopœial latinic titles of:—

1923.—Homatropine Bromide; Apomorphine Chloride; Quinine Bisulphate.

1924.—Solution of Arsenous Acid; Syrup of Hydriodic Acid.

1925.—Solution of Acetate of Ammonium; Solution of Chloride of Iron.

1926.—Lime Water; Solution of Potassa; Solution of Soda.

1927.—Compound Solution of Iodine: Solution of Chlorinated Soda.

1928.—Solution of Citrate of Potassium: Solution of Subacetate of Lead; Solution of Tersulphate of Iron.

1929.—Solution of Iodide of Arsenic and Mercury: Solution of Citrate of Iron and Quinine.

1930.—Solution of Arsenite of Potassium; Solution of Silicate of Sodium; Solution of Chloride of Zinc.

Write the nominative and genitive, and the proper abbreviations, of the latinic titles of:—

1931.—Herb, Herbs; Leaf, Leaves; Flower, Flowers: Fruit, Fruits; Seed, Seeds.

1932.—Root, Roots; Tuber, Tubers; Rhizome, Rhizomes; Bulb, Bulbs; Corm, Corms.

1933.—Bark, Barks; Stem, Stems; Twig, Twigs: Top, Tops; Gland, Glands.

1934.—Gum; Starch; Fixed Oil, Fixed Oils; Volatile Oil, Volatile Oils.

Write the nominative and genitive, and the proper abbreviations, of the latinic titles of:—

1935.—Resin, Resins; Gum-Resin, Gum-Resins; Oleoresin, Oleoresins.

1936.—Species; Powder, Powders; Compound Powder.

1937.—Trituration, Triturations; Abstract, Abstracts.

1938.—Extract, Extracts; Fluid Extract, Fluid Extracts; Powdered Extract, Powdered Extracts.

1939.—Confection, Confections; Troche, Troches; Mass, Masses; Pill, Pills; Bolus, Boli.

1940.—Granule, Granules; Capsule, Capsules; Jelly; Paste; Pastiles.

1941.—Cataplasm, Cataplasms, Paper, Papers.

1942.—Ointment, Ointments; Cerate, Cerates; Plaster, Plasters; Oleate, Oleates; Suppository, Suppositories.

1943.—Solution, Solutions; Mixture, Mixtures; Water, Waters; Mucilage, Mucilages.

1944.—Infusion, Infusions; Decoction, Decoctions; Compound Decoction, Compound Infusion.

1945.—Emulsion, Emulsions; Syrup, Syrups; Glycerite, Glycerites.

1946.—Spirit, Spirits; Tincture, Tinctures; Wine, Wines; Ethereal Tincture, Ammoniated Tincture, Compound Tincture.

1947.—Vinegar, Vinegars; Collodion, Collodions; Liniment, Liniments.

1948.—Injection, Injections; Lotion, Lotions; Gargle, Gargles.

1949.—Vapor, Vapors; Inhalation, Inhalations; Hypodermatic Injection: Bath, Baths.

Write the nominative and genitive of the complete latinic and the nominative of the scientific American pharmacopœial titles of:—

1950.—Gum Arabic, Tragacanth, Arrow-root. Malt, Honey.

1951.—Castor Oil, Almond Oil, Cod Liver Oil. Cotton Seed Oil. Linseed Oil. Croton Oil, Cacao Butter, Fixed Oil of Nutmeg.

1952.—Lard, Suet, Wax, Spermaceti.

1953.—Volatile Oils of: Turpentine, Savine, Lavender, Lavender Flowers. Rosemary, Orange, Lemon, Bergamot, Cubeb.

1954.—Volatile Oils of: Anise, Caraway, Fennel, Thyme, Peppermint, Pennyroyal, Sassafras, Star Anise, Cloves, Allspice. Wintergreen, Nutmeg.

1955.—Volatile Oils of: Bitter Almond. Mustard.

1956.—Camphor, Aloes, Opium, Catechu, Kino, Kamala.

1957.—Ammoniac. Asafetida, Gamboge, Scammony, Myrrh.

1958.—Wormwood, Aconite, Sweet Almonds. Bitter Almonds, Kousso, Ergot, Cloves.

1959.—Barley, Quince Seed, Marshmallow Root, Irish Moss, Iceland Moss.

1960.—Bitter Orange Peel, Sweet Orange Peel. Lemon Peel, Nutmeg.

1961.—Turpentine, Male Fern, Blue Flag, Sweet Flag, Ladies' Slipper. Snake root. Ginger.

1962.—Cayenne Pepper. Black Pepper. Hops. Yerba Santa.

1963.—Benzoin. Balsam of Tolu, Balsam of Peru. Storax.

Write the nominative and genitive of the complete latinic and the nominative of the scientific American pharmacopœial titles of:—

1964.—Jalap, Mandrake, Indian Hemp, Cotton Root Bark.

1965.—Dandelion, Liquorice Root, Rhubarb, Yellow Dock.

1966.—Culver's Root, Seneka Snake Root, Black Cohosh, Poke Root, Squill.

1967.—Buckthorn Bark, Black Haw, Butternut Bark, Black Alder.

1968.—Pipsissewa, Foxglove, Levantic Wormseed, German Wormseed.

1969.—Fish berries, Colocynth, Rhatany, Blackberry Root Bark, Oak Bark, Nutgall, Sumach.

1970.—Deadly Nightshade, Belladonna Leaf, Belladonna Root.

1971.—Henbane, Stinkweed, Hemlock Seed.

1972.—Aconite Leaf, Calabar Bean, Colchicum Seed, American Hellebore.

1973.—Blood Root, Jaborandi, Ipecac, Quebraccho, Pomegranate Root Bark.

1974.—Pareira Brava, Broom, Golden Seal, Coca Leaves.

1975.—Wild Cherry Bark, Black Mustard, White Mustard.

1976.—Spanish Flies, Castor, Musk, Ox gall, Leeches.

Write in full the correct latinic pharmacopœial titles of:—

1977.—Abstract of Nux Vomica; Stronger Ammonia Water; Orange Flower Water.

Write in full the correct latinic pharmacopœial titles of:—

1978.—Chlorine Water; Simple Cerate; Cantharidal Cerate.

1979.—Cerate of Extract of Cantharides; Nitrate of Potassium Paper; Cantharidal Collodion.

1980.—Flexible Collodion; Styptic Collodion; Elixir of Orange.

1981.—Ammoniac Plaster with Mercury; Galbanum Plaster.

1982.—Isinglass Plaster; Burgundy Pitch Plaster; Canada Pitch Plaster; Soap Plaster.

1983.—Aqueous Extract of Aloes; Extract of Arnica Root; Extract of Aconite Root.

1984.—Aromatic Fluid Extract; Fluid Extract of Bitter Orange Peel; Alcoholic Extract of Belladonna.

1985.—Extract of Indian Cannabis; Fluid Extract of Chestnut Leaves; Fluid Extract of Colchicum Seed.

1986.—Fluid Extract of Cornus; Fluid Extract of Coca; Extract of Wahoo Bark.

1987.—Extract of Yellow Jessamine; Extract of Logwood; Fluid Extract of Witch Hazel.

1988.—Extract of Iris; Extract of Juglans; Fluid Extract of Matico.

1989.—Extract of Calabar Bean; Fluid Extract of Wild Cherry; Fluid Extract of Rhus Glabra.

1990.—Fluid Extract of Yellow Dock; Compound Fluid Extract of Sarsaparilla.

Write in full the correct latinic pharmacopœial titles of:—

1991.—Fluid Extract of American Hellebore; Inspissated Ox-gall.

1992.—Glycerite of Yolk of Egg; Blue Pill; Copaiba Pill.

1993.—Compound Iron Mixture; Basham's Mixture; Dewee's Carminative.

1994.—Brown Mixture; Neutral Mixture; Mixture of Rhubarb and Soda.

1995.—Mucilage of Sassafras Pith; Oleoresin of Male Fern; Denarcotized Opium.

1996.—Saccharated Pepsin; Compound Pills of Antimony; Pills of Aloes and Mastic.

1997.—Antimonial Powder; Seidlitz Powder; Dover's Powder.

1998.—Spirit of Ether; Spirit of Nitrous Ether; Sweet Spirit of Nitre.

1999.—Syrup of Tar; Syrup of Raspberry; Syrup of Tolu.

2000.—Tincture of Arnica Flowers; Tincture of Benzoin; Tincture of Kino.

2001.—Camphorated Tincture of Opium; Deodorized Tincture of Opium; Sweet Tincture of Ruhbarb.

2002.—Tincture of Green Soap; Tincture of Sumbul; Tincture of Tolu; Tincture of Ginger.

2003.—Troches of Morphine and Ipecac; Troches of Chlorate of Potassium.

2004.—Cold Cream; Chrysarobin Ointment; Diachylon Ointment.

2005.—Ointment of Ammoniated Mercury; Ointment of Carbonate of Lead.

Write in full the correct latinic pharmacopœial titles of:—

2006.—Stronger White Wine; Bitter Wine of Iron; Compound Cathartic Pills.

ERRORS TO CORRECT.

Correct all errors you can discover in the following titles:—

2007.—Acidum Acetici Dilutus; Acidum Arsenosum.

2008.—Acidum Boracicus; Acidum Cromicum; Acidum Hydribromicum.

2009.—Acidum Phosforicum; Acidum Sulfurosum; Acidum Salycilicum.

2010.—Ether Aceticum; Ether Fortior; Alcohol Dilutus.

2011.—Alumen Exsicatus; Alumini Sulphas; Amonii Carbonas.

2012.—Amyli Nitris; Antimoni et Potassæ Tartras; Antimonum Sulphuratum.

2013.—Aqua Ammonii; Aqua Chlori; Argenti Nitras Fusum.

2014.—Arsenii Iodidum; Atropiæ Sulphas; Auri et Sodæ Chloridum.

2015.—Bismutii et Amonæ Citras; Calcis Carbonas Precipitata; Calci Hypophosphas.

2016.—Calx Clorata; Carbonei Bisulfidum; Chloroformum Venalus.

2017.—Cinchonidæ Sulphas; Cræta Preparata; Feri Chloidum.

2018.—Ferri Oxidum Hydratas; Feri Sulphas Exicatum; Hydrargyri Chloridum Corosivus.

Correct all errors you can discover in the following titles:—

2019.—Hydrargyri Chloridum Mitus; Hydrargyri Iodidum Viride.

2020.—Hydrargyri Subsulphas Flava; Liquor Acidi Arseniosum; Liquor Ferri Acètas.

2021.—Liquor Ferri Chloridum; Liquor Magnesiæ Citras; Liquor Plumbii Subacetatis.

2022.—Liquor Potasæ Arsenitis; Liquor Sodæ Chlorate; Liquor Sodæ Arsenatis.

2023.—Lithiæ Salycilas; Magnanii Oxidum Nigrum; Mistura Ferri et Amoniæ Acetas.

2024.—Morphiæ Hydrochloras: Pepsina Sacharatum Physostigmæ Salycilas.

2025.—Picrotoxina; Piperina; Potassiæ et Sodiæ Tartras.

2026.—Proxylina; Glycerina; Salicinum; Veratrina.

2027.—Quinini Bisulphis; Quinini Murias; Quiniæ Bromidum.

2028.—Santonina: Sodiæ Acetas; Sodæ Bicarbonas Venale.

2029.—Sodæ Carbonas Exsiccatum; Spiritus Ammonii Aromaticus; Strychnini Sulphas.

2030.—Syrupus Acidi Hydroiodici: Syrupus Calcis Lactophosphatus; Syrupus Ferri Quiniæ et Strychnini Phosphatis.

2031.—Syrupus Hypophosphitum; Tinctura Iodinii; Tinctura Gelseminum; Trochisi Ammoniæ Chloridi.

2032.—Trochisi Sodiæ Santonatis; Unguentum Hydrargyri Oxidum Rubrum; Unguentum Sulphur Alkalinum.

Correct the following faulty terms so as to give to each its correct orthography and termination in the *genitive* singular. Also write correct abbreviations such as may be properly employed in prescriptions (the genitive being understood to be the form abbreviated): [Most of these examples have been taken from actual prescriptions, written or printed.]

2033.—Spts. Nit. Dul.
2034.—Potassi Bromidi.
2035.—Cupri Sulp.
2036.—Potassi Iodinii.
2037.—Syr. Ferri Iodinii.
2038.—Syr. Ferr. Iodi.
2039.—Potas. Iodi.
2040.—Etheris.
2041.—Spt. Ether. Nit.
2042.—Mag. Sulph.
2043.—Tinct. Opi.
2044.—Emplas. Plumbi.
2045.—Abs. Dig.
2946.—Ext. Nuxi Vomi.
2047.—Acetat. Scilla.
2048.—Amoni Carb.
2049.—Argent. Nit.
2050.—Bism. et Ammonia Cit.
2051.—Cer. Plum. Sub.
2052.—Ex. Col. Sem. Fl.
2053.—Extra. Pod.
2054.—Ext. Rumex Fl.
2055.—Ferr. Lac.
2056.—Ext. Glycyrr. Fl.
2057.—Ext. Fran. Fl.
2058.—Zinc. Acet.
2059.—Zin. Sulph.
2060.—Tinct. Gen. Co.
2061.—Hyd. Chlor. Cor.
2062.—Hyd. Ammon.
2063.—Ferr. Sulph. Exsic.
2064.—Syr. Alli.
2065.—Lin. Cam.
2066.—In. Digit.
2067.—Phil. Phos.
2068.—Tin Card. Co.
2069.—Sacc. Lac.
2070.—Liq. Pot.
2071.—Træ Benzoin.
2072.—Tinct. Cubeb.
2073.—Ol. Amyg. Expres.
2074.—Ac. Phos. Dil.
2075.—Ung. Hyd. Nit.
2076.—Oleor. Aspidi.
2077.—Ferri Cit.
2078.—Spr. Acid. Citr.
2079.—Tinct. Auran. Am.
2080.—Ergotinæ ʒj.
2081.—Bromini.

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2082.—Acon.
2083.—Aqua Acidi Carb.
2084.—Sodii Chlor.
2085.—Chlor. Hydr.
2086.—Ext. Chel. Fl.
2087.—Ammon.
2088.—Tinct. Ang.
2089.—Ext. Aspid. Fl.
2090.—Tinct. Physo.
2091.—Cinch. Sulph.
2092.—Elat. gr. j.
2093.—Gal. Pulv.
2094.—Pot. Hyd.
2095.—Sodii Hypo.
2096.—Tinct. Cal.
2097.—Alcoholi.
2098.—Tinc.Guaiac. Ammon.
2099.—Pot. Bitart.
2100.—Ext. Col. Fl.
2101.—Ext. Hydr. Fl.
2102.—Ung. Iod.
2103.—Olei Sinapis.
2104.—Ext. Lact. Fl.
2105.—Argent. Iodid.
2106.—Bis. Subnitr.
2107.—Aur. et Sod. Chlor.
2108.—Quin. Sulph.
2109.—Ceri Oxalas.
2110.—Acidi Arsenios.
2111.—Acidi Sulph. f℥viij.
2112.—Cambogii.
2113.—Alumini. Exsiccat.
2114.—Olei Amygd.
2115.—Piper. gr. x.
2116.—Ammoni Benzoat.
2117.—Aq. Am.
2118.—Ext. Sen. Fl.
2119.—Hydr. Sub.
2120.—Bals. Peru.
2121.—Argenti Oxid.
2122.—Abs. Jalap.
2123.—Carboni Ligni.
2124.—Tinct. Capsic.
2125.—Bismuth. Citr.
2126.—Atropin. Sulph.
2127.—Hydr. Sulph.
2128.—Ant. Sulph.
2129.—Calci Carb. Precip.

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2130.—Acet. Scill.
2131.—Acid. Acetic. Dil.
2132.—Olei Menthæ.
2133.—Amylis Nitratis.
2134.—Calcii Chloratæ.
2135.—Felli Bovi Insp.
2136.—Olei Pip. Nig.
2137.—Ferri et Pot. Tart.
2138.—Ferri et Strych. Citr.
2139.—Ferri Redactis.
2140.—Aqu. Cinnamom.
2141.—Ext. Iris.
2142.—Ung. Hydr. Ammoniatis.
2143.—Extr. Nux Vomicæ.
2144.—Olei Cubebi.
2145.—Cret. Preparat.
2146.—Aqua Creasot.
2147.—Aqua Distil.
2148.—Calcii Chloratæ.
2149.—Ext. Canabis Indic.
2150.—Ext. Corni Fl.
2151.—Carbonis Bisulphid.
2152.—Liq. Magnesiæ Citr.
2153.—Syrupis Auranti.
2154.—Ferri Pyrophosphis.
2155.—Ext. Stramoni.
2156.—Mellis Despumatis.
2157.—Emplas. Picis Burgun.
2158.—Ext. Cascar. Flu.
2159.—Decoct. Sarsa. Co.
2160.—Ex. Digitalis. Fld.
2161.—Lupulinæ.
2162.—Pilocarpi Hydrochloras.
2163.—Olei Sabini.
2164.—Hydr. Subsul. Flavum.
2165.—Veratriæ Oleatis.
2166.—Ext. Juglantis.
2167.—Ex. Physostigmæ.
2168.—Santoninæ.

Correct the following faulty terms so as to give to each its correct orthography and termination in the *genitive* singular. Also write correct abbreviations such as may be properly employed in prescriptions (the genitive being understood to be the form abbreviated): [Most of these examples have been taken from actual prescriptions, written or printed.]

2169.—Hydr. Sulph. Rubrum.
2170.—Liq. Iodinii Com.
2171.—Ext. Leptandrin.
2172.—Oleores. Piperi.
2173.—Lithii Salicylas ℥j.
2174.—Liq. Pepsinæ.
2175.—Ext. Pruni Verginiani Fld.
2176.—Vin. Antimoni.
2177.—Extr. Rhus Glabra Fl.
2178.—Olei Gaultherii.
2179.—Sapo Viride.
2180.—Ung. Hyd.
2181.—Ol. Tigli.
2182.—Glycerinæ.
2183.—Liq. Pottassi Arsenitis.
2184.—Ex. Pinus Canaden.
2185.—Syrupus Tolutani.
2186.—Emp. Bellad.
2187.—Spiriti Ætheris Nitr.
2188.—Pil. Cathartici Co.
2189.—Spir. Ammonii Arom.
2190.—Tinct. Kini.
2191.—Troch. Sodæ Bicarb.
2192.—Spt. Chloroform.
2193.—Camphor. ℈j.
2194.—Sacchari Alb.
2195.—Pulvis Antimon. gr. x.
2196.—Sulphuri Sublimati.
2197.—Tinct. Sanguinarii.
2198.—Trochiscus Cubebæ unum.
2199.—Ol. Olivæ.
2200.—Syr. Simp.
2201.—Aq. Dis.
2202.—Calcis Calcinatæ.
2203.—Morphiæ Hydrochlor.

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2204.—Hydrargyri Oxidi Flavæ.
2205.—Ungt. Hydr. Iodi Rubri.
2206.—Cocaini Hydrochloratis.
2207.—Pul. Ac. Boracici.
2208.—Hydrarg. Prot.
2209.—Ex. Gentian.
2210.—Thymoli.
2211.—Collodii c. Cantharidi.
2212.—Pulv. Sulph. Subl.
2213.—Ext. Aloe Aq.
2214.—Ex. Aloe Socot.
2215.—Ætheris Sulphuri.
2216.—Spt. Etheris Nitro.
2217.—Syr. Acid. Citratis.
2218.—Suppositoriæ Opii. no. j.
2219.—Atropinæ Sul.
2220.—Morphiæ Sul.
2221.—Acid. Sulphuric. Arom.
2222.—"Delphinii (alkaloid of staphisagria)."
2223.—Pepsinæ Cryst.
2224.—Decoc. Hordei.
2225.—Ess. Rosari.
2226.—Sat. Sol. Cocaini Muriatis.
2227.—Confectio Sennæ ℥j.
2228.—Ex. Aloe Aqueosi.
2229.—Mass. Hydrarg.
2230.—Ex. Colo. Co.
2231.—Syr. Zingiberi.
2232.—Aquæ Destil.
2233.—Syr. Simplici.
2234.—Tr. Myrrh.
2235.—Acet. Plumbi.